JUDGE S.

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JOHN L. DAUER, JR. (JD 1763)
T. DAVID BOMZER (TB 7499)
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NEW YORK, NY 10036
(212) 297-5800
ATTORNEYS FOR
PLAINTIFF PIXFUSION LLC

08 CV 01202

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UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

PixFusion LLC,

Plaintiff,

v.

JibJab Media, Inc.

Defendant.

COMPLAINT
AND JURY DEMAND

Plaintiff PixFusion LLC, by their attorneys, Day Pitney LLP, files this Complaint and Jury Demand against Defendant JibJab Media, Inc., and states as follows:

PARTIES

1. Plaintiff PixFusion LLC ("PixFusion") is a limited liability company organized and existing under the laws of the State of Delaware, having its principal place of business at 390 Park Avenue South, 3rd Floor, New York, NY 10016.

2. Defendant JibJab Media, Inc. ("JibJab") is a California corporation, having its principal place of business at 228 Main Street, Suite 4, Venice, California 90291-5202.

JURISDICTION AND VENUE

3. This is an action for patent infringement arising under the Acts of Congress relating to patents, including Sections 101 *et seq.* of Title 35 of the United States Code.

4. This Court has subject matter jurisdiction over this action under Sections 1331 and 1338(a) of Title 28 of the United States Code.

5. This Court has personal jurisdiction over Defendant JibJab by virtue of, among other things, Defendant's offer for sale of the infringing products in the Southern District of New York.

6. Venue is proper in the Southern District of New York pursuant to Sections 1391(b) and (d) of Title 28 of the United States Code.

FACTUAL BACKGROUND

Plaintiff PixFusion's Products and Services

7. PixFusion is known as an innovator in the personalized media field.

8. PixFusion manufactures and produces high quality, customized media products.

9. For example, PixFusion, under its Kideo brand, manufactures and produces personalized media productions for children using licensed characters such as Spider-Man, Dora the Explorer, Barney, Arthur, Care Bears and Baby Genius.

10. PixFusion has sold over 500,000 of its Kideo personalized media productions.

11. PixFusion also develops and provides promotional media products.

12. PixFusion distributes its personalized media products and services throughout the United States and around the world.

Plaintiff PixFusion's Technology and Patents

13. PixFusion has developed proprietary software and technology to manufacture and produce its media products and services.

14. PixFusion also owns patents that embody the fruits of its innovations.

15. One such patent is United States Patent Number 6,351,265 ("the '265 Patent"), which is entitled "Method and Apparatus For Producing an Electronic Image" and has an issue date of February 26, 2002, attached hereto as Exhibit A.

16. Another such patent is United States Patent Number 5,623,587 ("the '587 patent"), which is entitled "Method and Apparatus For Producing an Electronic Image" and has an issue date of April 22, 1992, attached hereto as Exhibit B.

17. PixFusion is the current assignee of the '265 and '587 Patents.

18. PixFusion has licensed to third parties its proprietary intellectual property platform, including the '265 and '587 patents, for uses in consumer products, television and promotional applications.

Defendant JibJab's Infringement

19. JibJab operates a web site that has several pages and that has the following main address: http://www.jibjab.com/ ("Website").

20. On the Website, JibJab offers for use and/or for sale personalized "Sendables Starring You!" movies.

21. To create a personalized movie, a Website user selects a movie.

22. A Website user navigates the Website to upload a photograph.

23. A Website user uses tools on the Website to, *inter alia,* outline a head in the photograph and to identify the location of the mouth.

24. The Website cuts the head out of the photo and prepares the head for use in a movie.

25. The Website user confirms use of the head in a movie and the Website loads the head into a movie.

26. Once the Website produces the movie, the Website user may forward via email to another user a link to the movie on the Website.

27. In some cases, the Website user will have to pay to forward via email the movie.

28. Upon information and belief, JibJab makes, uses and offers for use personalized movies that infringe the '265 Patent and may infringe the '587 Patent.

COUNT I
(Infringement of the '265 Patent)

29. PixFusion repeats and re-alleges Paragraphs 1-25 as if fully set forth herein.

30. JibJab has infringed, and will continue to infringe the '265 Patent in violation of Section 271 of Title 35 of the United States Code by making, using, selling and or offering to sell the inventions claimed in the '265 Patent, and/or inducing or contributing to such infringement by others, in the Southern District of New York and without the consent of PixFusion.

31. Unless enjoined by the Court, JibJab will continue its alleged infringement of the '265 Patent.

32. As a direct and proximate result of JibJab's alleged infringing conduct, PixFusion has suffered, and will continue to suffer, irreparable harm, for which they have no adequate remedy at law.

33. Unless this Court enjoins JibJab's alleged infringing conduct, PixFusion will continue to be irreparably harmed by JibJab's infringement of the '265 Patent.

34. As a direct and proximate result of JibJab's alleged infringing conduct, PixFusion has suffered, and will continue to suffer, damages.

35. Unless this Court enjoins JibJab's alleged infringing conduct, PixFusion will continue to suffer damages by JibJab's infringement of the '265 Patent.

36. JibJab had actual notice its personalized media products infringed the '265 Patent, in response to which, JibJab did not cease its alleged infringement of the '265 Patent in wanton disregard of PixFusion's rights thereunder.

37. As a direct and proximate result of JibJab' conduct, JibJab's alleged infringement of the '265 Patent has been willful and deliberate.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff PixFusion prays for the following relief:

A. A declaration that JibJab has infringed, contributorily infringed and/or induced the infringement of one or more of the claims of the '265 Patent;

B. A declaration that JibJab has willfully infringed the '265 Patent;

C. An injunction permanently restraining and enjoining JibJab (and its officers, directors, employees, agents, servants, successors, assigns, and any and all persons in

privy or in concert with it, directly or indirectly) from infringing any of the claims of the '265 Patent in any manner;

D. Damages adequate to compensate PixFusion for injuries sustained as a result of JibJab's infringement of the '265 Patent, but in no event less than a reasonable royalty, together with interest thereon;

E. Enhanced damages as a result of JibJab's willful infringement of the '265 Patent;

F. A declaration that this case is exceptional;

G. An assessment and award of interest, costs, and attorneys fees against JibJab; and

H. For such other and further relief as the Court deems just and proper.

JURY DEMAND

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Plaintiff PixFusion respectfully requests a jury trial on all issues so triable.

DATED: February 5, 2008

Day Pitney LLP
Attorneys for Plaintiff
PixFusion LLC

By: _____

Marc A. Lieberstein (ML 7116)
John L. Dauer, Jr. (JD 1763)
T. David Bomzer (TB 7499)

Exhibit A

US006351265B1

(12) **United States Patent**
Bulman

(10) **Patent No.: US 6,351,265 B1**
(45) **Date of Patent: Feb. 26, 2002**

(54) **METHOD AND APPARATUS FOR PRODUCING AN ELECTRONIC IMAGE**

(75) Inventor: **Richard L. Bulman**, New York, NY (US)

(73) Assignee: **Personalized Online Photo LLC**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/300,987**

(22) Filed: **Apr. 28, 1999**

Related U.S. Application Data

(63) Continuation of application No. 08/840,486, filed on Apr. 21, 1997, which is a continuation-in-part of application No. 08/489,564, filed on Jun. 12, 1995, now Pat. No. 5,623,587, which is a continuation-in-part of application No. 08/138,531, filed on Oct. 15, 1993, now abandoned.

(51) **Int. Cl.**[7] **G06F 15/00**
(52) **U.S. Cl.** **345/435**
(58) **Field of Search** 345/435, 433, 345/473, 474, 113, 114

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,645,459 A * 2/1987 Graf et al. 345/435
5,623,587 A * 4/1997 Bulman 345/435

* cited by examiner

Primary Examiner—Phu K. Nguyen
(74) *Attorney, Agent, or Firm*—Milde, Hoffberg & Macklin, LLP

(57) **ABSTRACT**

A method of providing normalized images, comprising the steps of:

(a) receiving an electronic representation of an image including a head;

(b) extracting the head from the image;

(c) determining a size of the head;

(d) rescaling the head to a plurality of desired sizes; and

(e) outputting the plurality of rescaled heads as printed images on a medium.

27 Claims, 14 Drawing Sheets

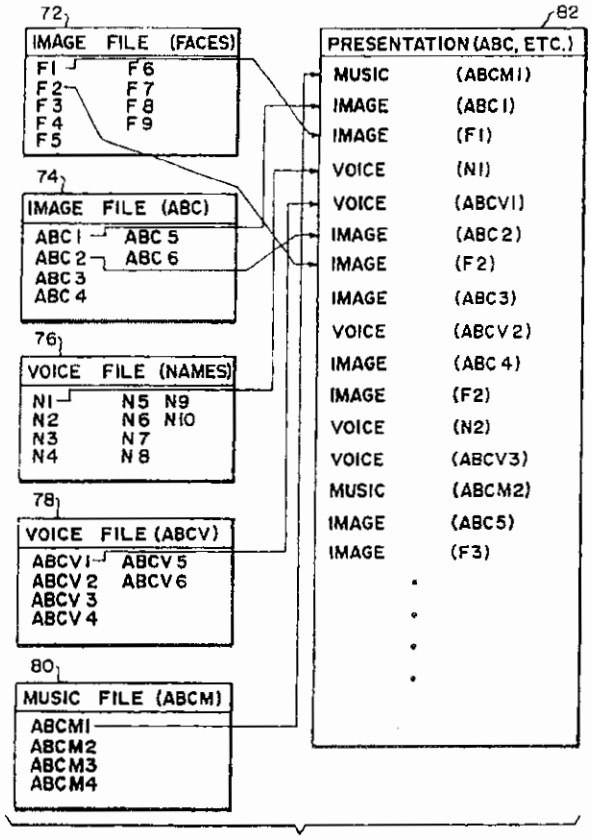
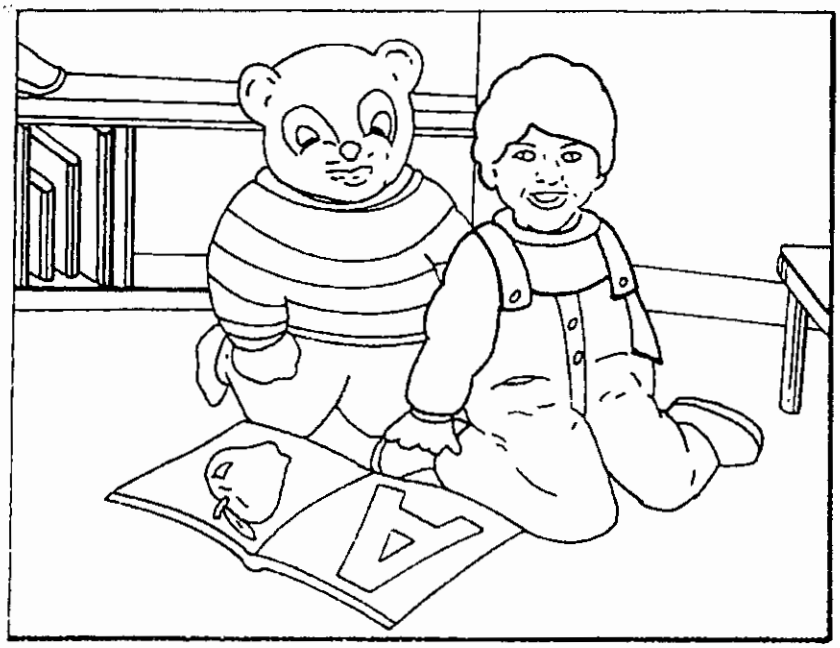


FIG.1



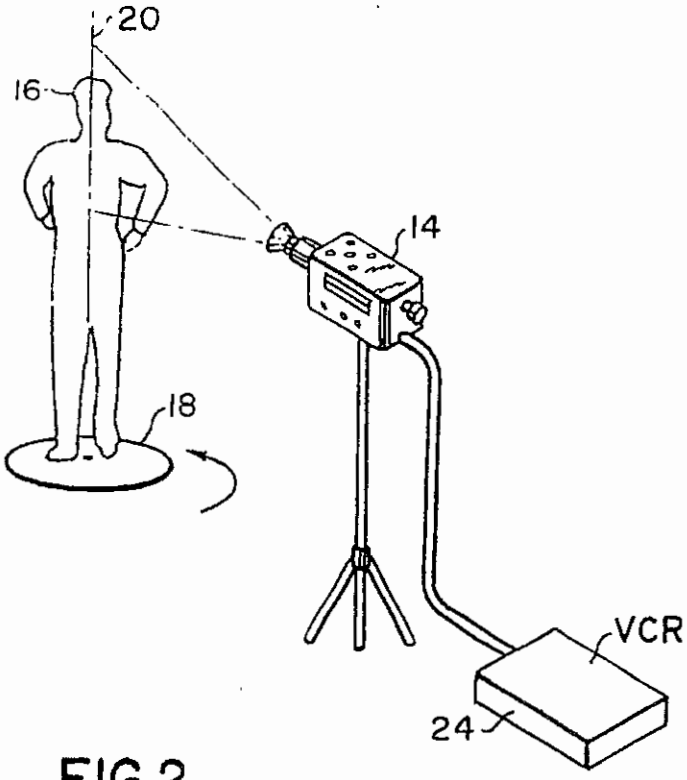


FIG.2

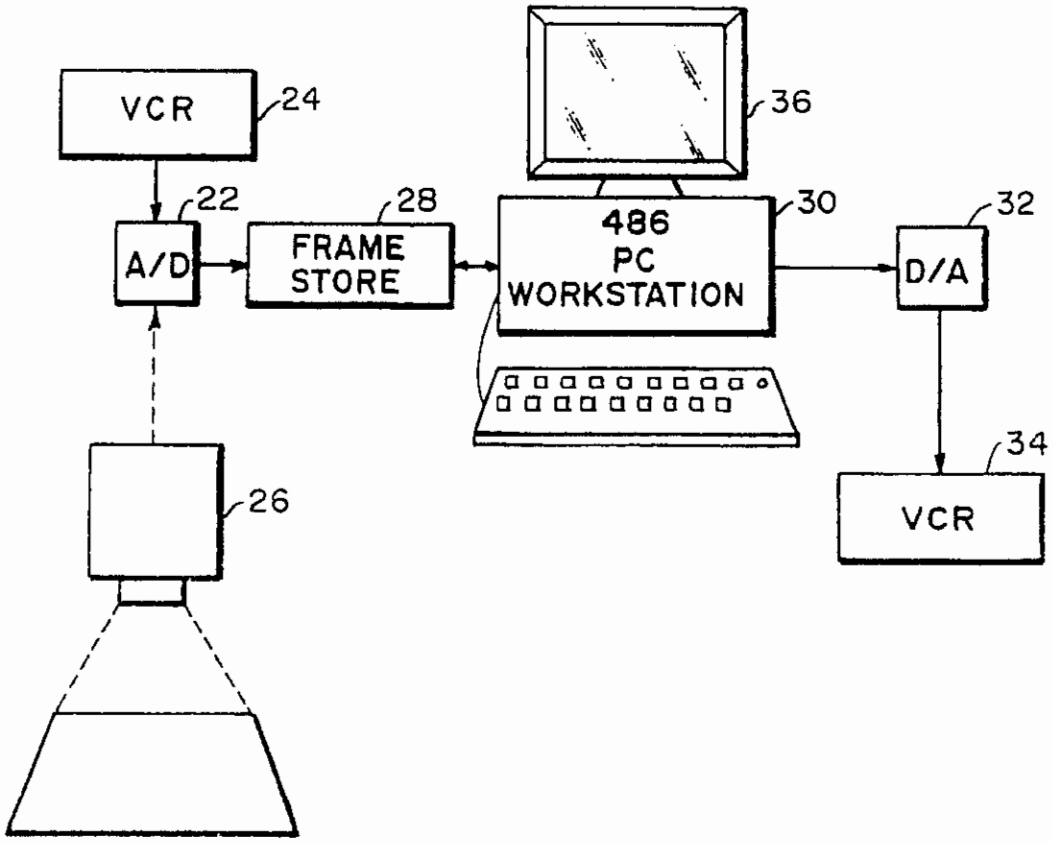


FIG.3

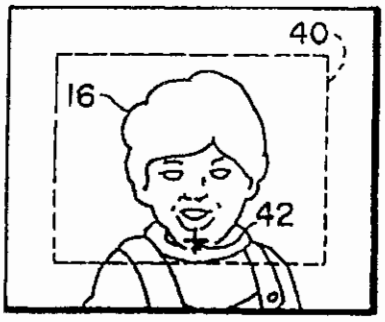


FIG.4A

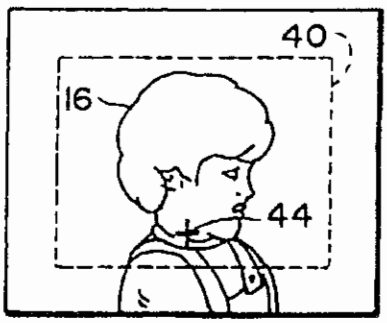


FIG.4B

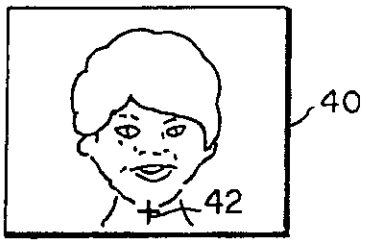


FIG.5A

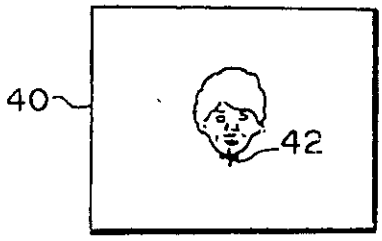


FIG.5B

FIG.6

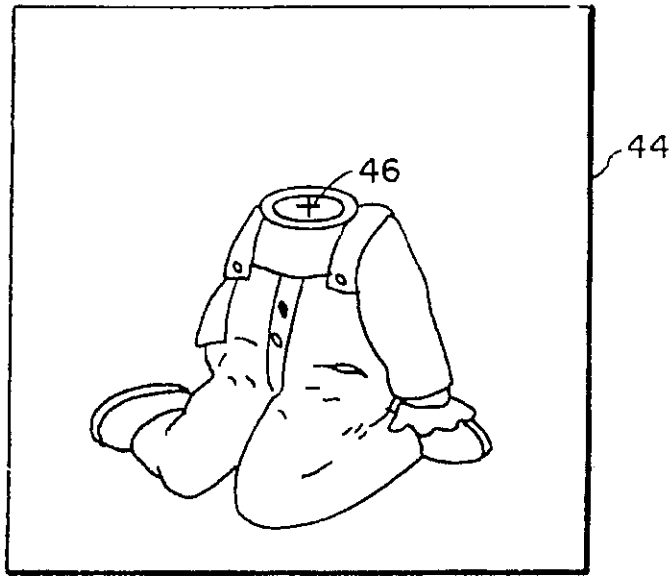
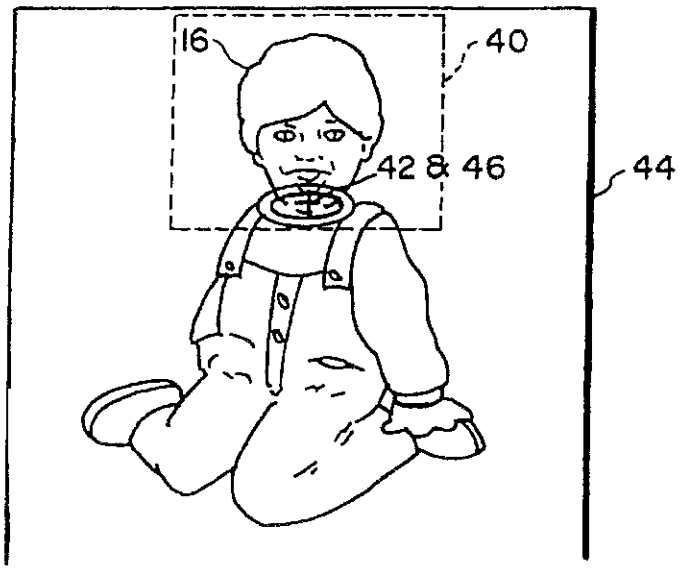


FIG.7



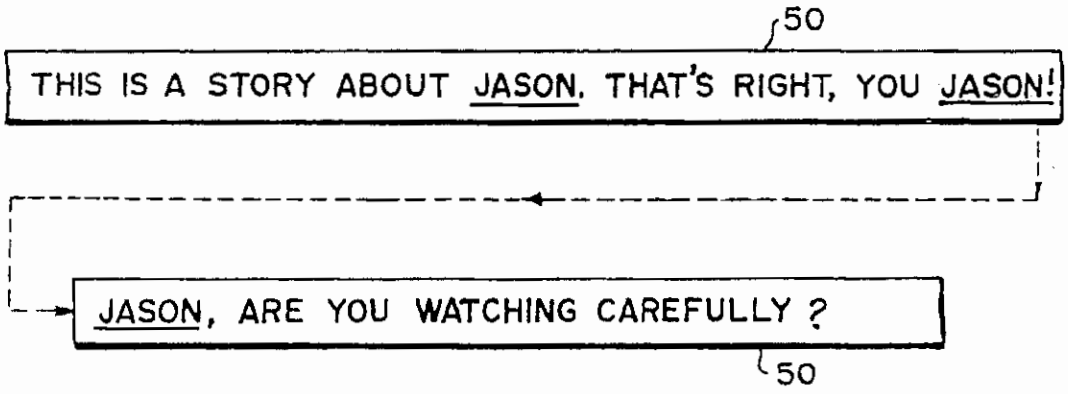

50
THIS IS A STORY ABOUT JASON. THAT'S RIGHT, YOU JASON!
JASON, ARE YOU WATCHING CAREFULLY ?
50

FIG.8

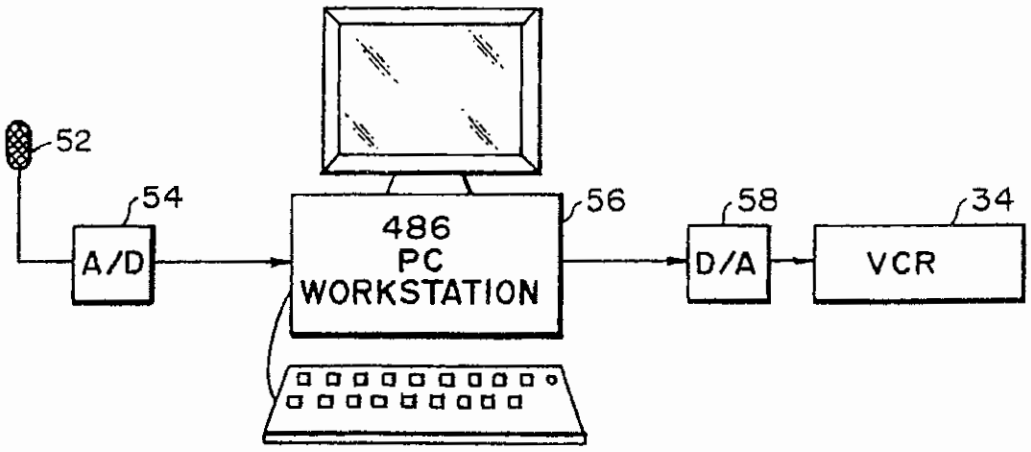

52
54
A/D
486
PC
WORKSTATION
56
58
D/A
34
VCR

FIG.9

FIG.10

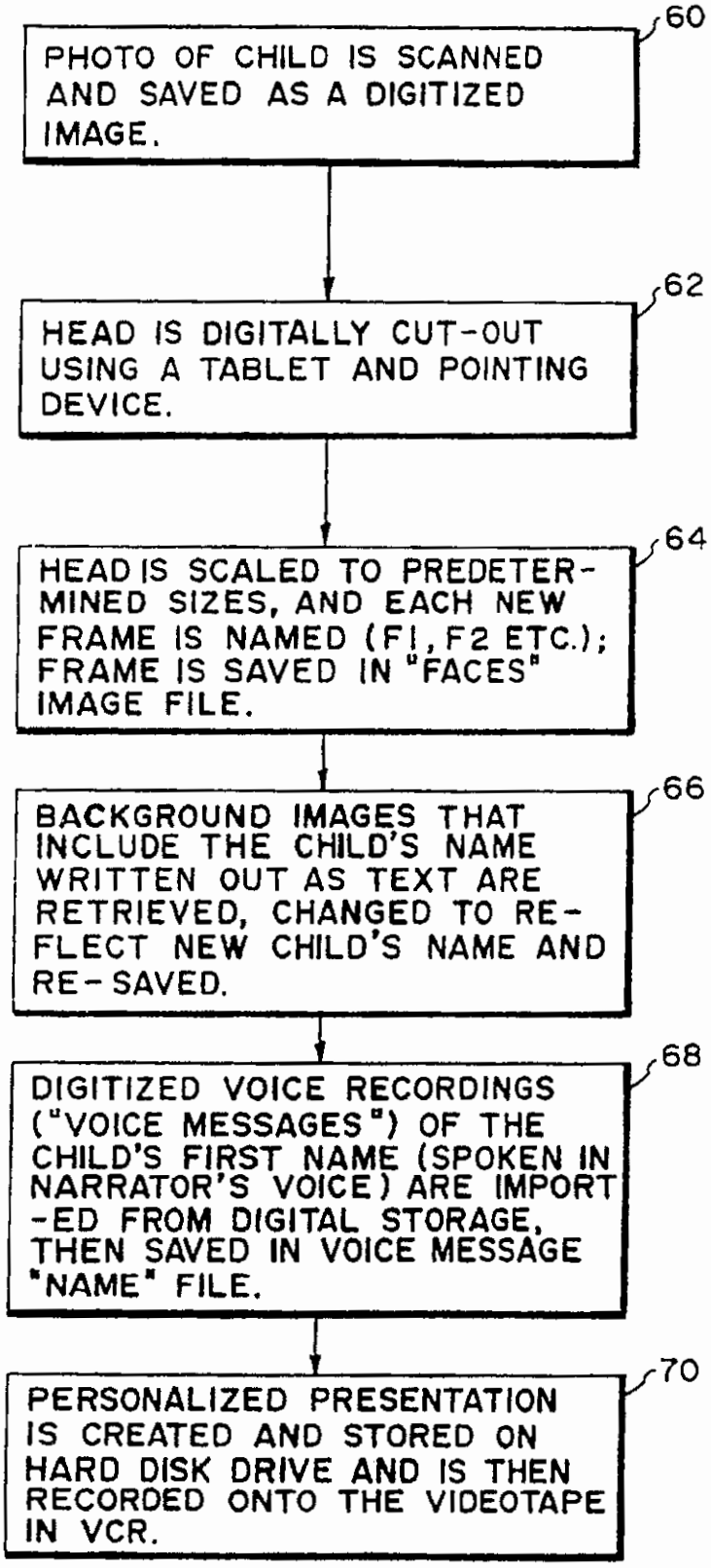
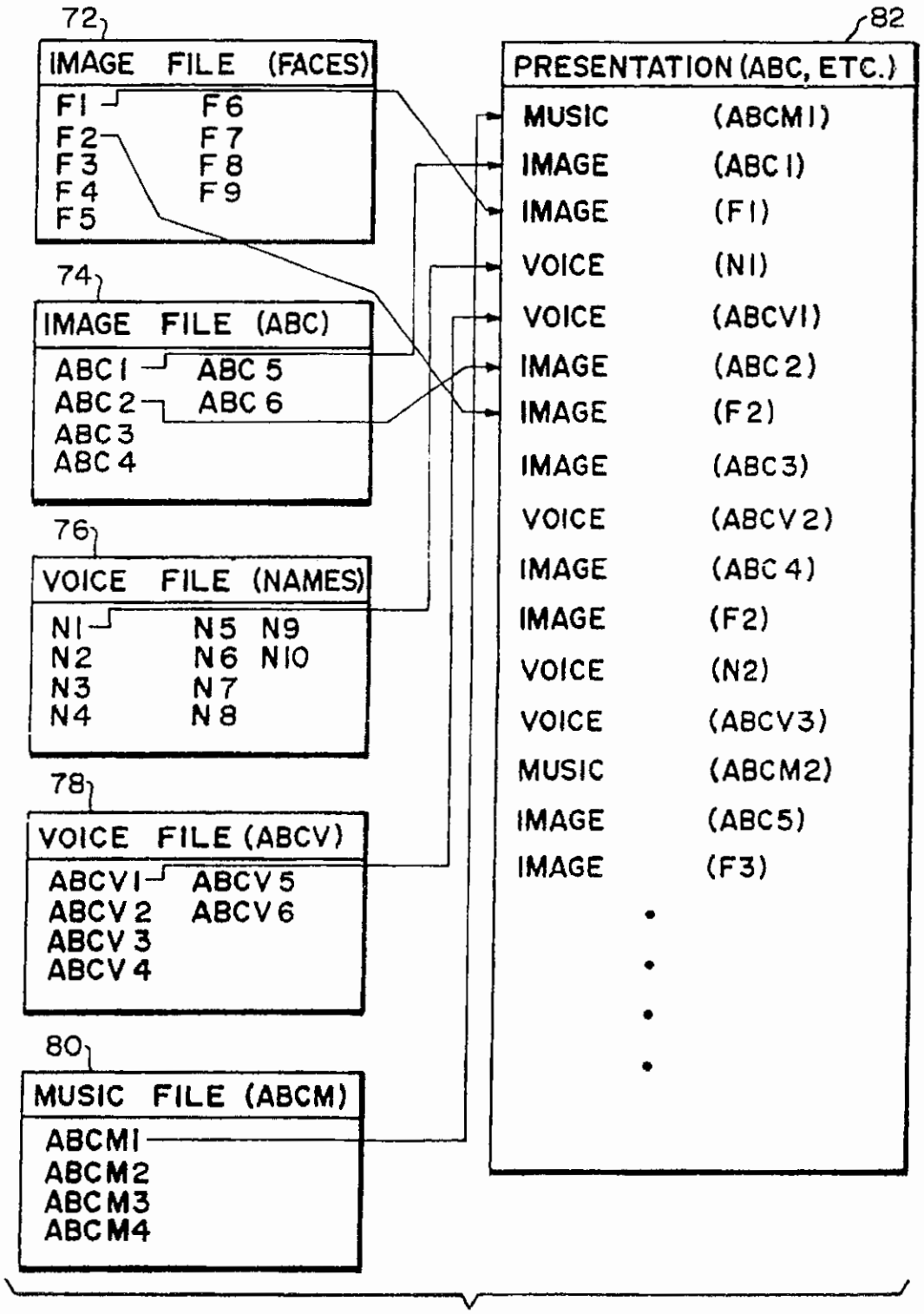


PHOTO OF CHILD IS SCANNED AND SAVED AS A DIGITIZED IMAGE.
60
HEAD IS DIGITALLY CUT-OUT USING A TABLET AND POINTING DEVICE.
62
HEAD IS SCALED TO PREDETERMINED SIZES, AND EACH NEW FRAME IS NAMED (F1, F2 ETC.); FRAME IS SAVED IN "FACES" IMAGE FILE.
64
BACKGROUND IMAGES THAT INCLUDE THE CHILD'S NAME WRITTEN OUT AS TEXT ARE RETRIEVED, CHANGED TO REFLECT NEW CHILD'S NAME AND RE-SAVED.
66
DIGITIZED VOICE RECORDINGS ("VOICE MESSAGES") OF THE CHILD'S FIRST NAME (SPOKEN IN NARRATOR'S VOICE) ARE IMPORTED FROM DIGITAL STORAGE, THEN SAVED IN VOICE MESSAGE "NAME" FILE.
68
PERSONALIZED PRESENTATION IS CREATED AND STORED ON HARD DISK DRIVE AND IS THEN RECORDED ONTO THE VIDEOTAPE IN VCR.
70

FIG.11


72
IMAGE FILE (FACES)
F1
F2
F3
F4
F5
F6
F7
F8
F9
74
IMAGE FILE (ABC)
ABC1
ABC2
ABC3
ABC4
ABC5
ABC6
76
VOICE FILE (NAMES)
N1
N2
N3
N4
N5
N6
N7
N8
N9
N10
78
VOICE FILE (ABCV)
ABCV1
ABCV2
ABCV3
ABCV4
ABCV5
ABCV6
80
MUSIC FILE (ABCM)
ABCM1
ABCM2
ABCM3
ABCM4
82
PRESENTATION (ABC, ETC.)
MUSIC (ABCM1)
IMAGE (ABC1)
IMAGE (F1)
VOICE (N1)
VOICE (ABCV1)
IMAGE (ABC2)
IMAGE (F2)
IMAGE (ABC3)
VOICE (ABCV2)
IMAGE (ABC4)
IMAGE (F2)
VOICE (N2)
VOICE (ABCV3)
MUSIC (ABCM2)
IMAGE (ABC5)
IMAGE (F3)

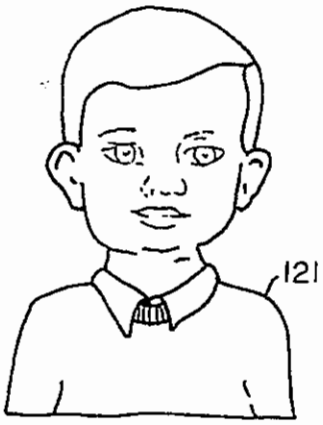


FIG.12A

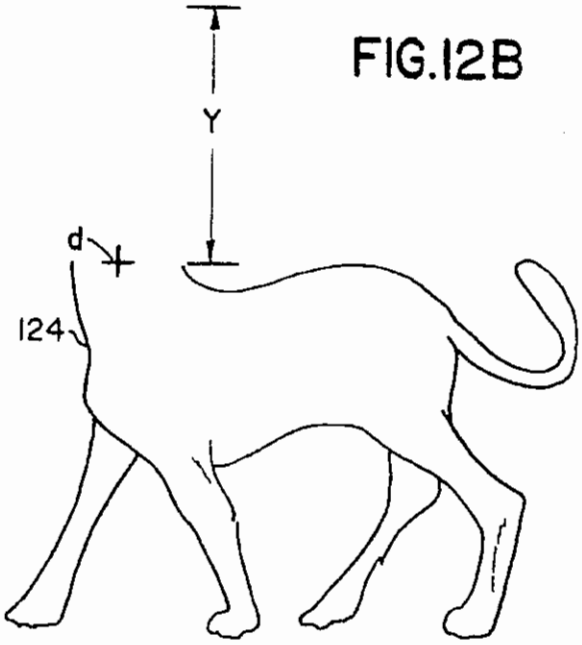


FIG.12B

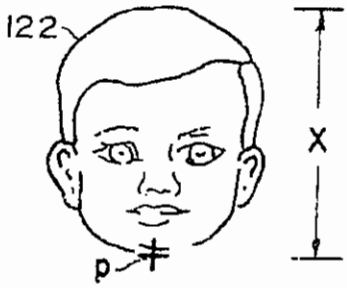


FIG.12C

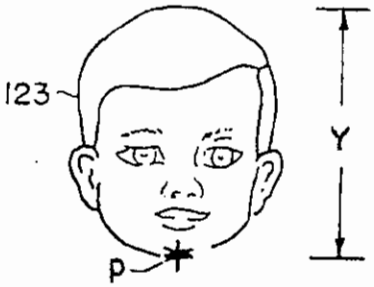


FIG.12D

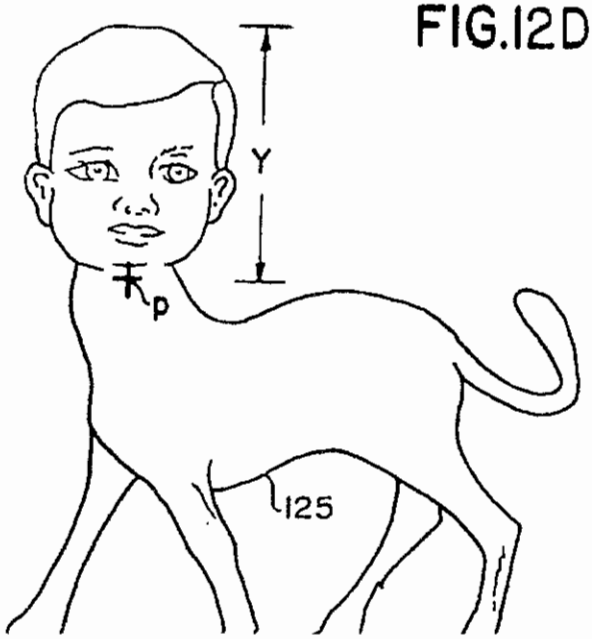


FIG.12E

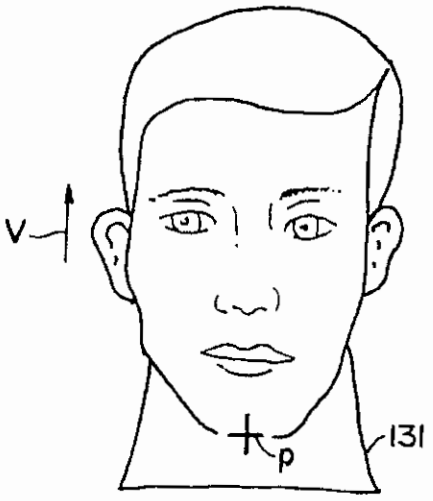


FIG.13A

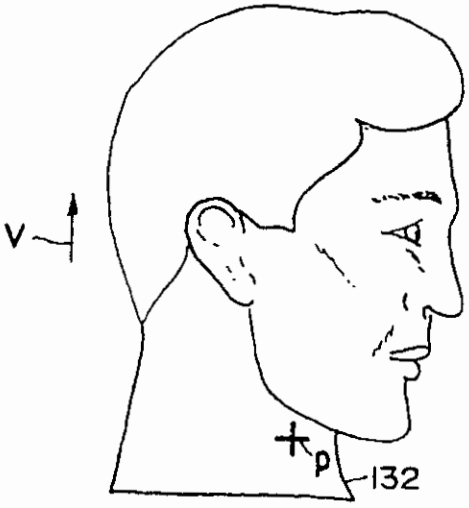


FIG.13B

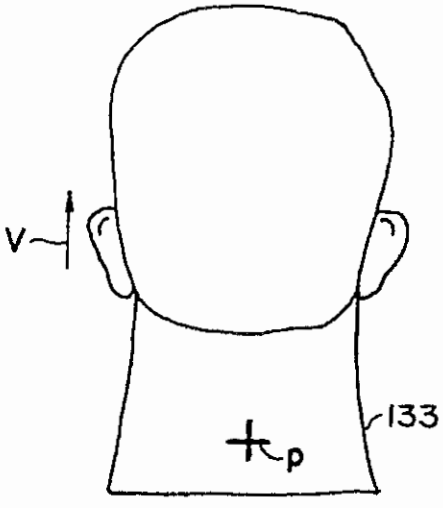


FIG.13C

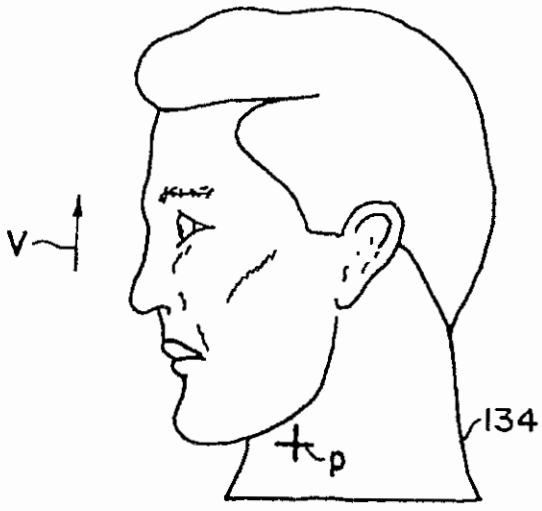


FIG.13D

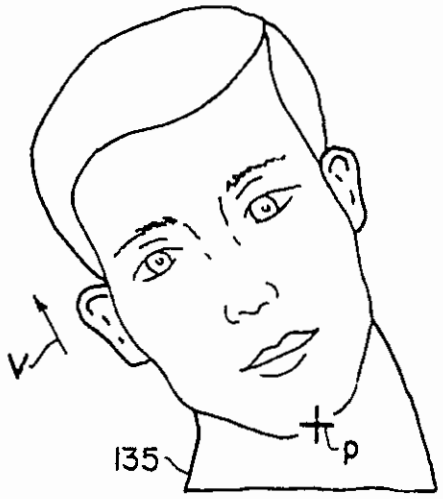


FIG.13E

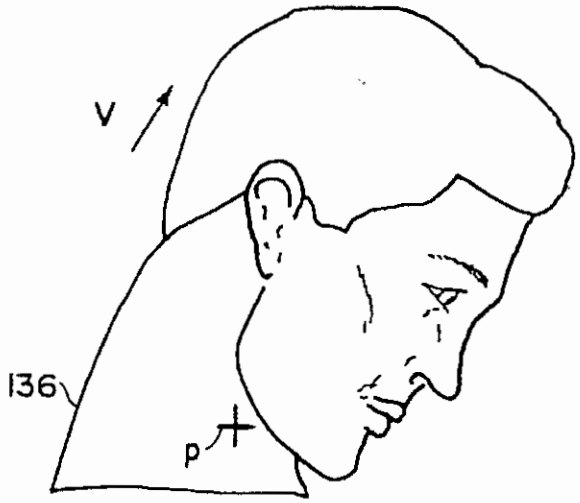


FIG.13F

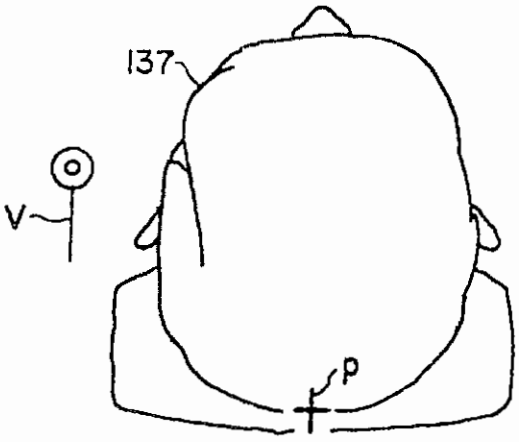


FIG.13G

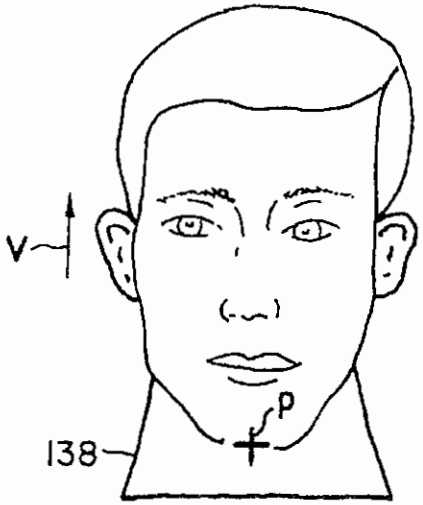
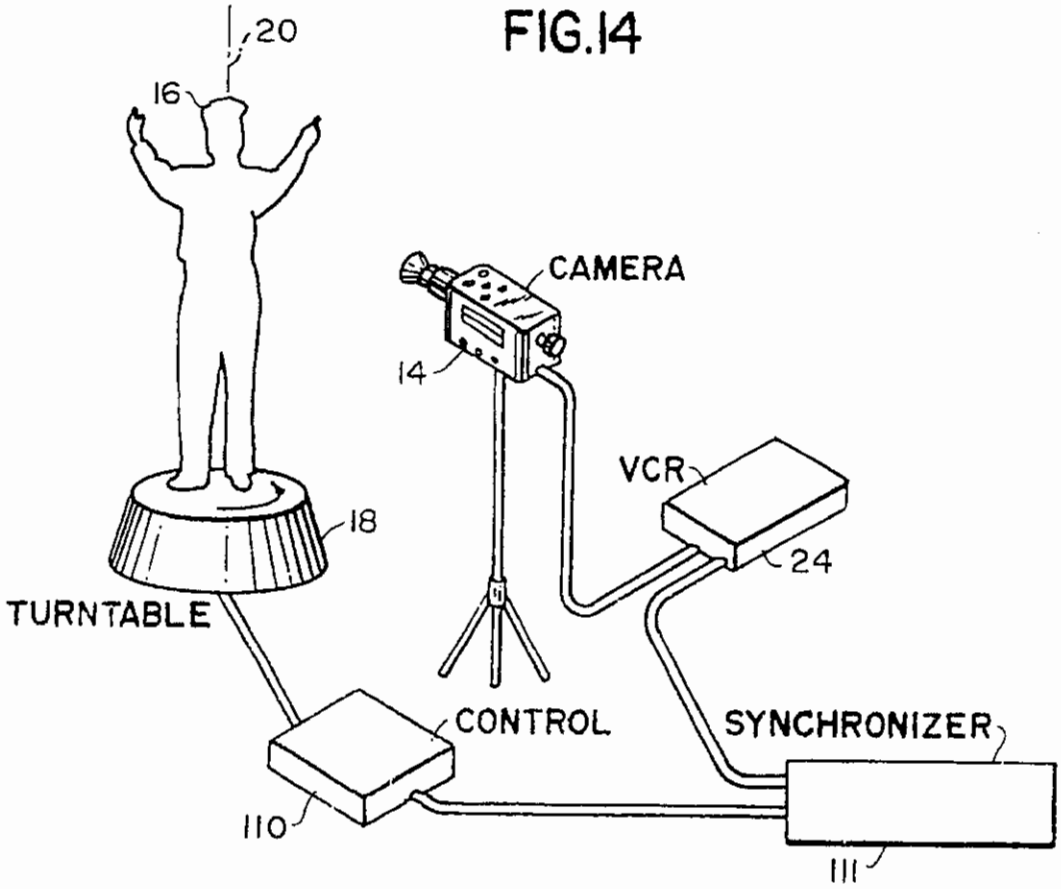


FIG.13H

FIG.14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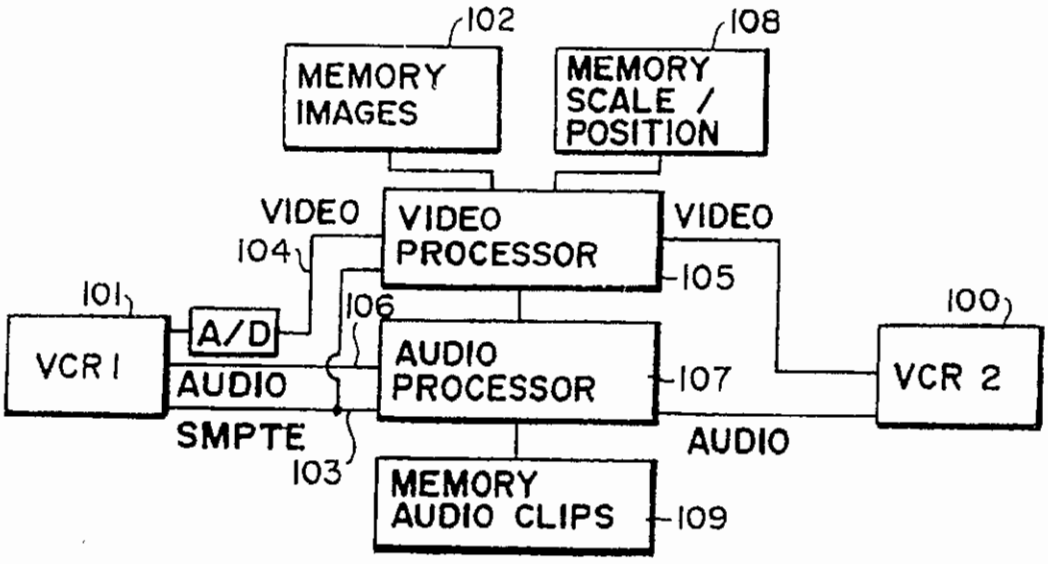
16
CAMERA
14
VCR
24
18
TURNTABLE
CONTROL
SYNCHRONIZER
110
111


102
MEMORY IMAGES
108
MEMORY SCALE / POSITION
VIDEO
104
VIDEO PROCESSOR
VIDEO
105
101
A/D
106
100
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AUDIO PROCESSOR
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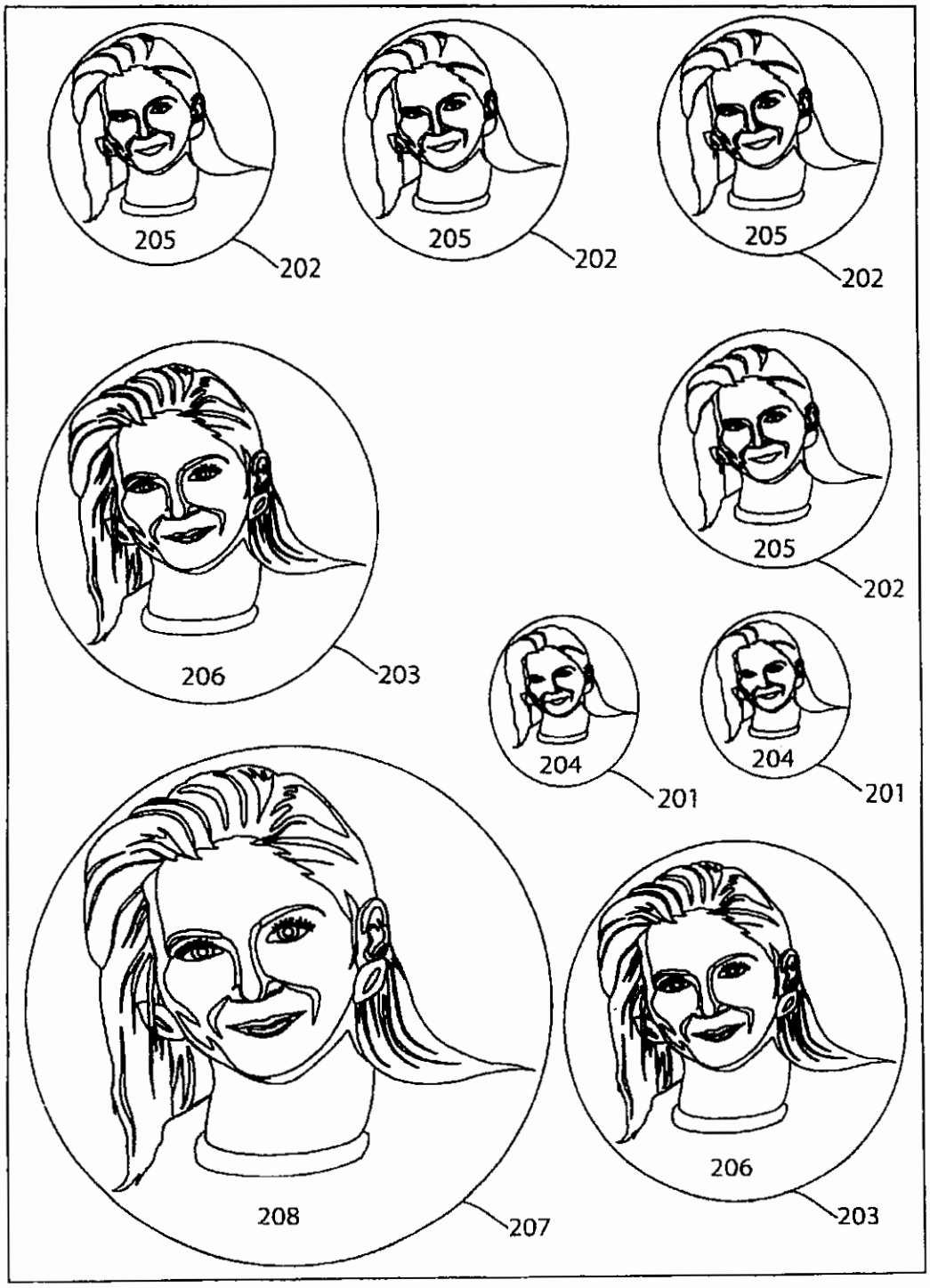
VCR 2
SMPTE
AUDIO
103
MEMORY AUDIO CLIPS
109

FIG.15


205
202
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203

Fig. 16

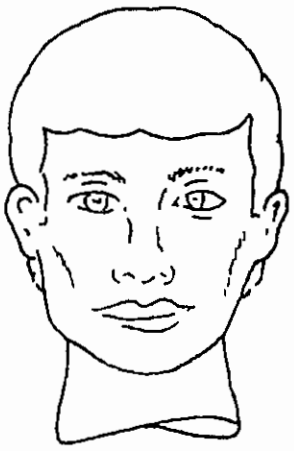


FIG.16A

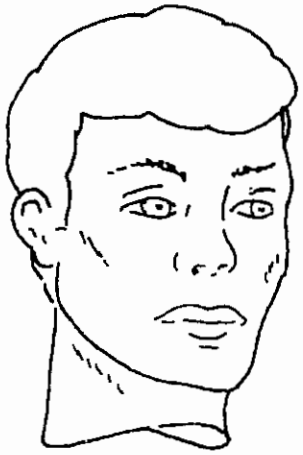


FIG.16B

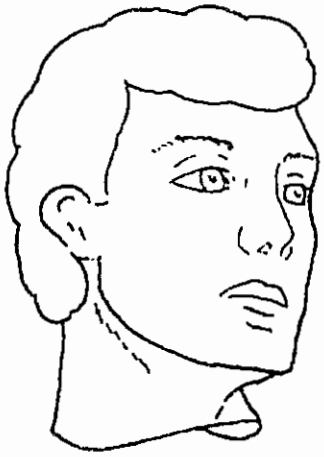


FIG.16C

FIG.16D

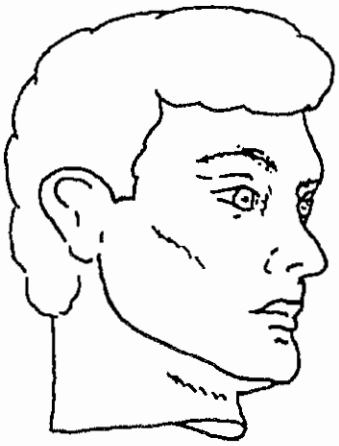
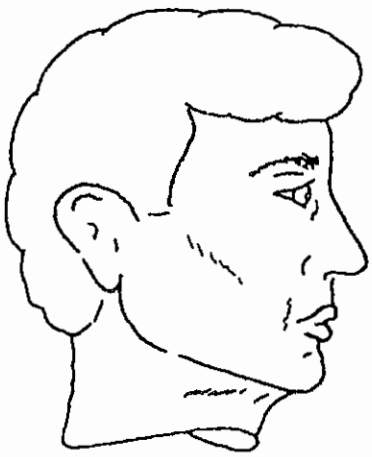


FIG.16E



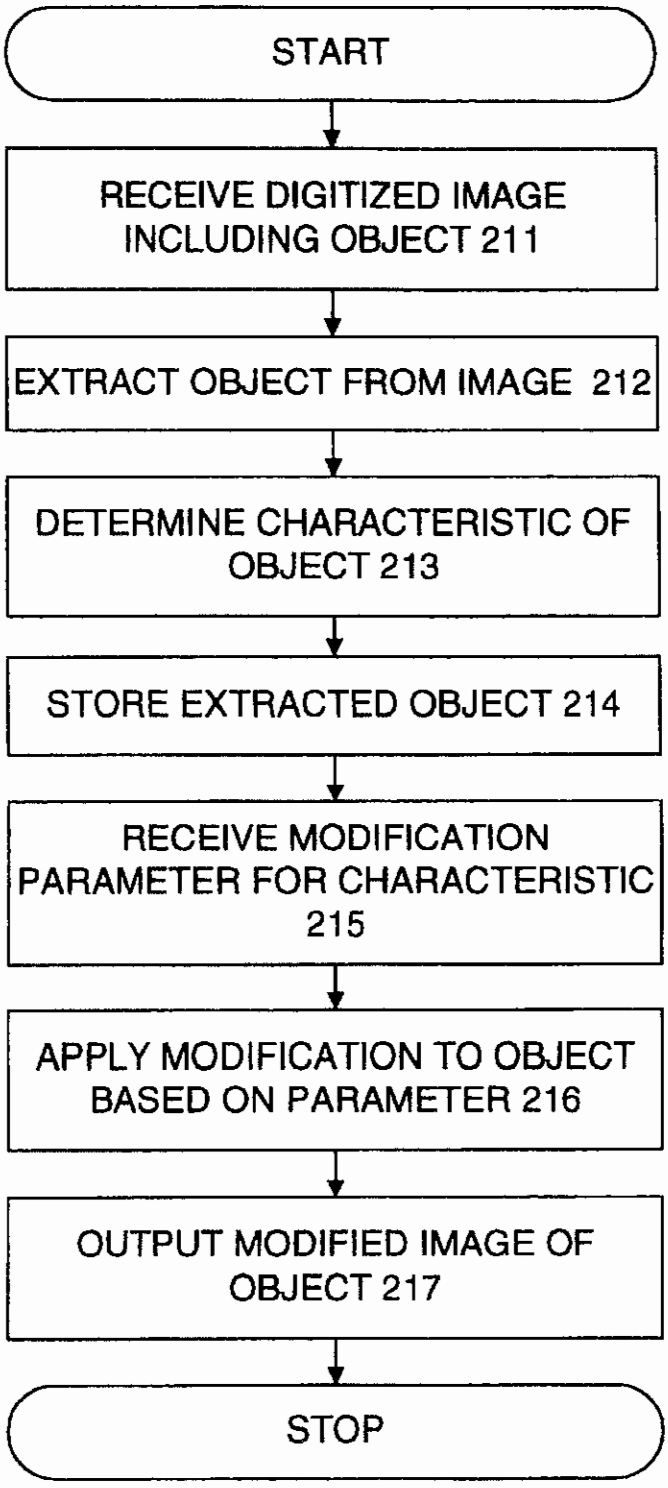

START
RECEIVE DIGITIZED IMAGE INCLUDING OBJECT 211
EXTRACT OBJECT FROM IMAGE 212
DETERMINE CHARACTERISTIC OF OBJECT 213
STORE EXTRACTED OBJECT 214
RECEIVE MODIFICATION PARAMETER FOR CHARACTERISTIC 215
APPLY MODIFICATION TO OBJECT BASED ON PARAMETER 216
OUTPUT MODIFIED IMAGE OF OBJECT 217
STOP

Fig. 17

FIG.17A

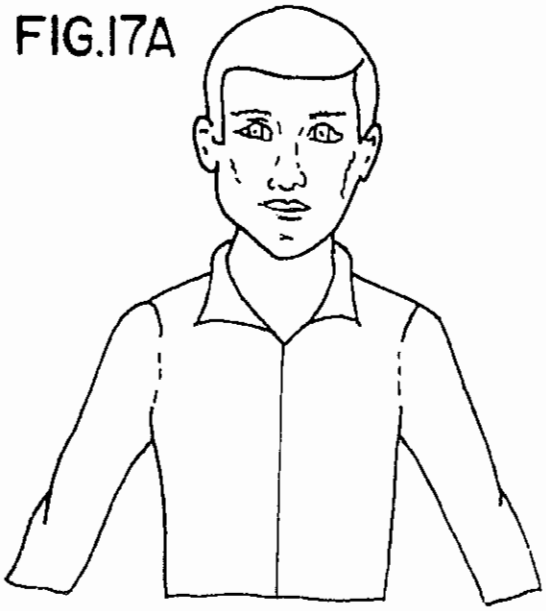
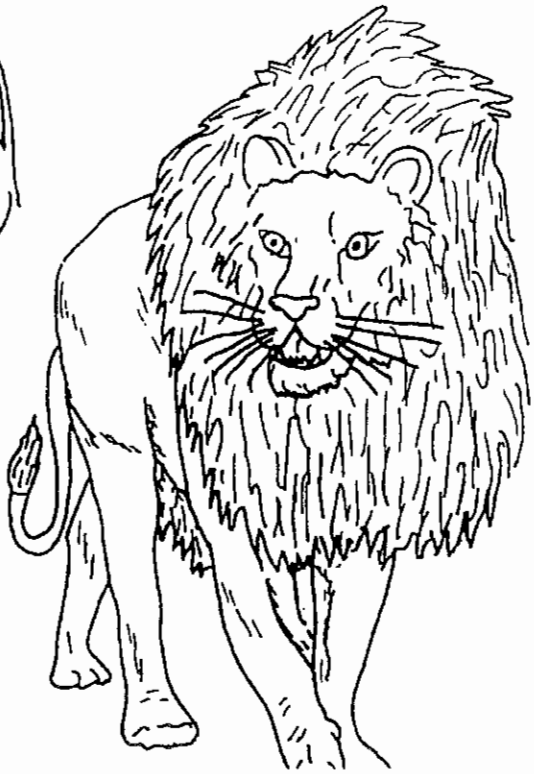


FIG.17B

FIG.17C



METHOD AND APPARATUS FOR PRODUCING AN ELECTRONIC IMAGE

REFERENCE TO RELATED APPLICATIONS

The present application is a continuation of U.S. patent application Ser. No. 08/840,486 filed Apr. 21, 1997, now abandoned which is a Continuation-in-part of 08/489,564, filed Jun. 12, 1995, now U.S. Pat. No. 5,623,587 each of which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for producing an image of a head, corresponding to a body image from another source, so that a resulting composite image has a natural orientation and size.

In the following description, the term "head" is intended to include not only the head of a human being with its hair (however long) face, ears, etc., but also any and all appurtenant accessories such as a hat, glasses, hair adornments, jewelry (earrings, etc.) and the like. The term "body" as it is used herein, is intended to include the body of a human being, animal, fish, etc., (either real or fictional) including not only the torso, arms, legs, tail, fins, etc., but also any and ail appurtenant clothing, shoes, jewelry, and the like. The "body" may also be another environment in which an image of a head is appropriate, such as a window, television screen or portal. The image of the head and/or body may be obtained from a "real" head or body, respectively, either photographically or by electronic image scanning, or from an artistic or computer generated rendering thereof

It is known to produce pictures of human subjects with the head of one human being superimposed upon the body of another human being, animal, fish, etc. This superposition is normally accomplished "mechanically" by cutting around the outline of the head of a person shown in a first photograph and applying this head, in the proper position and orientation, to a body in a second photograph. The resulting "mechanical" is thereafter photographed and/or scanned electronically to produce a third photograph or electronic image. Electronic implementation of this process is also known, where the head is electronically traced and superimposed.

This superposition process is time consuming and requires that the head and body in the first and second photographs, respectively, be adjusted in scale photographically; that is, that either the first or second photograph be enlarged or reduced so that the head and body are of the same relative size.

Consequently, this superposition process is only rarely used, and when used it is limited to situations where the cost of the process is small compared to the cost of the overall desired product.

It is also known to scan photographs electronically, which may be used to produce customized portraits on self-adhesive paper labels. It is also known to print a plurality of portrait photographs in a variety of sizes on photographic paper.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a method and apparatus for producing an output image including a size-normalized image of a digital image of an object. The object is generally an anatomical portion of a subject, such as a human or animal.

It is also an object according to the present invention to provide a method of producing an electronic image of a human subject, said method comprising the steps of:

(a) providing an electronic representation of an image of a head of said subject;

(b) providing an image containing a body corresponding to said head;

(c) producing a set of digital representations defining an actual size of said head in said electronic representation;

(d) providing a set of digital representations defining a desired size of said head corresponding to said body;

(e) processing said electronic representation of said image of said head in dependence upon the size information defined by said actual size and said desired size, representing said head scaled to said desired size; and

(f) outputting said processed electronic representation as an image of said head scaled to said desired size.

Advantageously, the method includes the further step of superimposing said outputted electronic representation of said head scaled to said desired size on said body. The image of the head may be, for example, a photograph, electronic still image, video image or a series of photographs. Non-electronic image media may be scanned or otherwise digitized for input. The head may be an artistic rendering, or a synthesized or actual image of a head. Likewise, the image containing the body may be an artistic rendering, or a synthesized or actual image of the body. The head and body images need not be of the same type, and advantageously, a processing step may be performed to modify either the head image, body image, or both, to increase a matching between the two. The images are preferably in natural colors; however, monochrome images, false colors, discrete color space images, cartoon images and the like may also be employed.

According to another object of the invention, the head has a reference vector and said body has a reference vector, wherein the head and body are combined to obtain a predetermined relationship of the reference vectors of said head and said body. These vectors may be a point; origin and magnitude; origin, magnitude and orientation, or include other information, and the vector space for the head need not be identical to the vector space for the body. Therefore, the combining step may include a processing of one image portion to correspond to another image portion. Likewise, the vector space may also include a set of varying or incrementally varying images, wherein the processing includes the step of selecting one of the images or synthesizing a new image from the set of images. For example, the image of the head may include a plurality of head images incrementally varying in rotation about a vertical axis, wherein the vector matching comprises selection of the head image having an appropriate angle for the body image.

In one embodiment, the reference point on the head is on the chin.

According to a still further object of the invention, the method may further include the steps of:

(g) providing a second image containing a second body corresponding to said head;

(h) providing a second set of digital representations defining a second desired size of said head corresponding to said body of said second image;

(i) processing said electronic representation of said image of said head in dependence upon the size information defined by said actual size and said second desired size, representing said head scaled to said second desired size; and

(j) outputting said processed electronic representation as an image of said head scaled to said second desired size.

It is a further object of the present invention to produce a reproduction of the combined image on a recording medium, which may be a printing medium or an electronic storage medium.

In order to facilitate alignment of the head and body, and relax the necessary tolerances for an aesthetically pleasing result, a collar may be provided on the body immediately adjacent to a location of said superimposed head. Alternately, a neck portion may be provided on the head, with a reference point on the neck. A soft pink border may be provided around the head.

According to a still further object of the invention, the images may be associated with audio information, such as spoken words. These words may include, for example, the name of the person whose head is included in the image.

According to another object of the invention, a plurality of desired head sizes are provided, and a plurality of heads are each processed and scaled to a different given size, and then the plurality of scaled heads are output.

It is also an object of the invention to provide aethod of producing a composite electronic image of a subject comprising the steps of:

(a) obtaining first image information relating to a first anatomical portion of a subject and producing a set of first representations of the first image;

(b) producing a set of size representations associated with the first image information defining a size of the first anatomical portion;

(c) providing a normalized size parameter;

(d) converting the set of first representations of the first image into a set of second representations, in dependence upon the normalized size parameter, the set of second representations defining the first anatomical portion scaled to the desired size; and

(e) outputting the second representations as image data.

The method may further comprise the steps of providing a plurality of desired anatomical portion sizes, and converting a plurality of anatomical portions, each of said anatomical portions being scaled to a different given size; and outputting said plurality of scale anatomical portions.

Another object of the invention is to provide a method of providing normalized images, comprising the steps of:

(a) receiving an electronic representation of an image including a head;

(b) extracting the head from the image;

(c) determining a size of the head;

(d) rescaling the head to a plurality of desired sizes; and

(e) outputting the plurality of rescaled heads as printed images on a medium.

A further object of the invention is to provide a method of providing a normalized image, comprising:

(a) receiving an electronic representation of an image;

(b) extracting an object from the image;

(c) determining a size of the object;

(d) rescaling the object to a desired size;

(e) electronically outputting an image of the object onto a plastic sheet having self-adhesion properties substantially without adhesive; and

(f) separating a portion of the plastic sheet having the output image of the object from a remainder of the sheet. The plastic sheet may be die-cut prior to forming the image thereon.

In a preferred embodiment, the output includes a series of portrait images including an image of a head extracted from its native background in a digital image of a subject, scaled to at least two sizes, which are then printed on a recording medium, such as paper, die-cut labels, plastic film, or the like. For example, the printed images may then be separated from the remainder of the recording medium, and then be superimposed upon a printed page having the body of another subject, which may be a person, animal, fish, etc.

It is a further object of the present invention to provide a method and apparatus for producing an image of the above-noted type which is substantially less time consuming and less costly than the superposition process known heretofore.

These objects, as well as further objects which will become apparent from the discussion that follows, are achieved, in accordance with the present invention, by a method, and by apparatus for carrying out a method, which comprises the steps of:

(a) obtaining first image information relating to a an anatomical portion of a subject and producing a set of first representations of the first image;

(b) producing a set of second representations associated with the first image information defining a size of the anatomical portion of the first image information;

(c) electronically separating the anatomical portion of the first image information from a remainder of the first image information;

(c) optionally processing the anatomical portion image information alter an appearance of the anatomical portion, based on a predetermined criteria;

(d) processing the anatomical portion image information to normalize a size of the anatomical portion according to a predetermined size criteria; and

(e) outputting the size-normalized image of the anatomical portion.

In a preferred embodiment, the image is scaled to a plurality of different sizes. The plurality of images may then be output to a single sheet, for example at predetermined locations.

The sheet is preferably a die-cut sheet of self-adhesive labels, such that the normalized size images are printed within the confines of a die-cut sticker, which may, for example, be placed on a sheet in a pre-printed book or pamphlet by an end-user.

The sheet may also be a "sticky" plastic sheet, e.g., polyvinyl chloride, used in such products as the known Colorforms®, which tend to adhere to itself or other surfaces without an adhesive, and can thus be repositioned or removed.

Alternately, the images may be printed directly on a sheet having images of corresponding anatomical portions, so that the printed anatomical portion physiologically joins the preprinted physiological portion. In this case, the printed anatomical portions may be of the same size, although the positioning will generally vary on differing printed sheets.

The optional processing of the anatomical portion may add or alter characteristics based on a morphing, tweening, cartoonization, colorization, recolorization, shading, shadowing, synthetic orientation alteration, or other image processing operation. Various structures may also be appended, grafted or merged onto the anatomical portion, for example to provide various animal features. For example, distinctive ears, nose, hair or the like may be provided in the printed image.

The printed image may also have an associated code indicative of a corresponding image for placement of the body part. This code may be a word, number, color code or other indicia.

In another embodiment, the body part images may be interchangeable for placement with a range of different background images, in the manner of the known "Mad Libs", allowing humorous combinations of foreground and background images. In this case, the various anatomical body part images may be of the same size yet differ in other additions or characteristics, as discussed above.

In another embodiment of the invention, the image of the anatomical portion may be merged with a video stream, wherein the location and scaling of the anatomical portion is selected or controlled so that the anatomical portion corresponds to and follows structures in the video stream. In this case, the video stream may be either a predetermined sequence, allowing the desired locations and scalings to be predetermined, or interactive, in which case the merging process in real time receives the location and/or scaling data corresponding to the video stream, and this data is employed to control the superposition process.

In the preferred embodiment according to the present invention, the anatomical portion is a head and the corresponding anatomical portion is a body, preferably derived from different subjects, i.e., the body is not the body of the subject from which the head is derived. However, it is also possible to merge the body and head of the same subject according to the present invention.

The anatomical image information is generally obtained either through an electronic camera or from scanning one or more still pictures. However, no particular type of image source is required. The corresponding anatomical image, as stated above, may be a preprinted page, still image, or video stream. The corresponding anatomical image may also be an electronic representation of a still or moving image, which allows the composite image to be output electronically as a still or animated image.

The system according to the present invention may be employed to generate a customized video game, wherein an image of a head of a person, e.g., the player, is employed as a "sprite" or translatable icon, within the video output. In accordance with the present invention, the scaling of the image may be controlled, as well as the application of special effects, which may be varied during the course of the video game.

In order to obtain the image of the anatomical portion, a user's local computer or computerized device may be provided with computer software to extract the anatomical portion, or this functionality provided at a central service bureau. While printed sheets and electronic storage media may be physically transported between a service bureau and the end user, advantageously, this image information is communicated electronically, through a direct dial-up link or through a computer network, such as the Internet.

Typically, the corresponding anatomical portion comprises an animated image or image sequence, a videotape, a series of still scenes, or a computer generated background. The corresponding anatomical portion image preferably has an anatomical adjoining part which allows normal appearing placement of the anatomical part of the first image, or includes a buffer zone which obscures misalignment or other visual artifacts from the merging process.

The positioning information preferably comprises a single point, and the size information preferably comprises a single dimension. The image of the anatomical portion, in such a case, is presumed to have a predetermined orientation. The corresponding anatomical portion image is therefore one in which the desired orientation matches that of the anatomical portion image. However, the positioning information may also include a vector defining one or more additional degrees of freedom, the anatomical portion image information comprising information relating to a three or four dimensional representation of the anatomical portion. Thus, the orientation, positioning, scaling, movement, or other characteristics of the anatomical portion may be controlled for a desired composite image. Generally, the purpose of the composite image formation is to customize a generic background image. Thus, the present invention allows the production of customized books, video tapes, video games, instructional or educational presentations, and the like.

The preparation for producing an output image may be a simple discrete superimposition of the anatomical portion image with the corresponding anatomical portion image information, or a more complex process. In a more complex process, the anatomical portion image may interact with representations of the corresponding anatomical portion image, so that higher order matching may be obtained for a smooth transition. For example, if the anatomical image portion is a head, and the corresponding anatomical image portion is a neck and torso, the base of the head may be "morphed" so that the outline of the superposed image is smooth. Likewise, colors may be altered or gradiented so that the hue and brightness have a smooth transition or match. Other types of higher order transition matching may also be effected.

Where the image is to be printed on a sheet, the characteristics of the corresponding anatomical portion image are generally known, and the printed image is scaled according to the known characteristics of the corresponding anatomical portion image. The scaled images are also positioned so as to be printed within predetermined confines of the sheet, such as within die cut portions.

In one embodiment, a dye sublimation printer is employed to print an image on a plastic sheet, which is then die cut around the images according to a predetermined pattern. The plastic sheet has adherence characteristics which allow it to adhere to, be repositioned and removed from other objects, such as plastic or plastic sheets, glass, smooth metal, or other surfaces. The printing process causes the image to diffuse into the plastic sheet, forming a permanent and durable image. The image may also be formed by ink-jet printing (using an ink which is compatible with the recording medium), thermal transfer printing or laser-type (toner particle) printing.

In the case of video image streams, the resulting image is preferably output to a video recording device and/or displayed on a video monitor.

In a video stream embodiment of the invention, audio information may be included within the process, with a customized portion associated with the anatomical portion image, which is in this case a foreground image, and a stock portion associated with the corresponding anatomical portion image, which is in this case a background image. In this way, the audio portion may be customized with relatively few insertions. A set of audio representations associated with the background image is used to determine the timing and optionally characteristics of information from the foreground image-associated audio information in a resulting soundtrack created by merging both streams of audio information.

The audio information associated with the foreground image may be, e.g., a name, spoken in various intonations, associated with the customized image information. The audio information associated with the background image may be, e.g., a story associated with a sequence of background images (regardless of the foreground image), with the set of audio identifiers relating to the timing and intonation of the name to be inserted in the soundtrack.

For a full understanding of the present invention, reference should now be made to the following detailed description of the preferred embodiments of the invention as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing one frame of an image in which a boy's head is superimposed upon a hand-drawn boy's body;

FIG. **2** is a perspective view showing how the head of a human subject, in various angular positions, which is electronically scanned to produce a plurality of electronic images;

FIG. **3** is a block diagram of an electronic system employed, according to the present invention, to produce electronic images of the type shown in FIG. **1**;

FIGS. **4***a* and **4***b* are image frames containing the head of a human subject in front and side views, respectively, as may be obtained with the apparatus of FIG. **2**;

FIGS. **5***a* and **5***b* depict image frames in which the head of a human subject has been enlarged and reduced in scale, respectively;

FIG. **6** depicts an image frame containing the body of a human subject, without a head;

FIG. **7** depicts an image frame in which the head of a human subject has been superimposed upon the body shown in FIG. **6**;

FIG. **8** is a representative diagram of a voice recording showing how the name of a person is inserted into a line of text;

FIG. **9** is a block diagram of the an electronic system, according to the invention, for inserting the name of a person in a voice recording;

FIG. **10** is a flow chart of a computer program for implementing the electronic image producing process in the apparatus of FIG. **3**;

FIG. **11** is a flow chart of a computer program for implementing the audio recording process in the apparatus of FIG. **9**;

FIG. **12** including FIGS. **12A–12E** is a graphical flow chart depicting the transformations according to the present invention;

FIG. **13** including FIGS. **13A—13A** depicts images having differing positioning;

FIG. **14** is a semi-schematic view of an apparatus for obtaining customization information;

FIG. **15** is a block diagram of an embodiment according to the present invention;

FIG. **16** including FIGS. **16A–16E** is a top view of a die cut sheet having printed head portions of an individual scales in various sizes; and.

FIGS. **17** and **17A–17B** are a flow chart and examples showing a method of forming images in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will now be described with reference to FIGS. **1–17**. Identical elements in the various figures are designated with the same reference numerals.

FIG. **1** illustrates a typical electronically displayed image frame wherein the head **10** of a male child is superimposed upon a hand-drawn body **12**. As may be seen, the head and body are in the proper relative proportions and the head is disposed upon the body at the proper location. This is the type of composite image results from the method and apparatus according to the present invention. In some embodiments, this composite is automatically produced, while in others, a person manually forms the composite image.

FIG. **2** illustrates how the head of a human subject can be scanned by an electronic scanner to form stored images. In this case, a video camera **14** is arranged to view the head **16** of the human subject. This human subject stands on a platform **18** which is rotated about a vertical axis **20**. In this way, a plurality of video frames are obtained, each containing the image of the head **16** in a different angular position. These video frames are stored on a video cassette recorder (VCR) **24**. The stored video frames may be thereafter digitized, in an analog-to-digital converter, to provide digital representations of each frame.

Alternatively, the video frames containing the image of a human head can be obtained from a photograph of the human subject. For example, a Hewlett-Packard ScanJet® scanner may be employed to electronically scan a photograph and produce digital representations defining an image frame. Perspective views of the subject may be artificially generated from one or more views of the subject, by processing the electronically stored image based on a model of a human subject's head.

In order to provide special effects, the stored image may be "morphed" with another image for display. The process of "morphing" involves interpolating between two corresponding images, with preservation of continuity between corresponding features, i.e., edges, eyes, nose, mouth, neck, hair, etc. This allows, for example, a more natural placement and posture of a human head on an animal or other type body, and assists in animating the human head according to a predetermined choreography.

EXAMPLE 1

FIG. **3** illustrates a first apparatus employed for implementing the image-making method according to the invention. As is shown there, the system comprises an analog-to-digital converter **22** which can receive video image frames from the video cassette recorder **24** or digitizes images in a flat bed scanner **26**. The flat bed scanner **26**, which may, for example, be a Hewlett Packard ScanJet® or Sony flat bed scanner, electronically scans an image, e.g., 82×11 inch hand drawn art work or an 8×10 inch photograph.

The digital representations of each image frame are supplied to a digital image frame store **28** which, in turn, is addressable by an IBM compatible 80486DX2/66 personal computer (PC) workstation **30**. Of course, Intel Pentium®, Apple Power PC, or other processors are known which may be employed for image processing. Alternately, less general purpose systems may be used, such as Net PCs, Web TVs, video game consoles, set-top boxes, and the like may be employed. In the case of a general purpose computer, the frame store is preferably an IBM rewritable optical disk, although a magnetic disk, RAM or other type of memory may be used to store the image frames. The PC workstation **30** is provided with a video adapter, such as is available from Targa Systems, Inc. of East Berlin, Connecticut, USA, under model name "True Vision Targa Plus **64** Board" for displaying television images on the workstation CRT screen **36** from digital representations of such images.

In one embodiment, the background images are stored as MPEG-1 or MPEG-2 files, which are stored in compressed

format and presented as necessary. The foreground image in this case may be merged after decompression, or merged in compressed format and subsequently decompressed. When merged in compressed format, the positioning of the foreground image is controlled by way of a motion compensation vector. Likewise, it is also possible to scale the foreground image using high level MPEG constructs, although it is preferred that the base scaling for a scene be performed on an uncompressed image, prior to compression. By using motion compensation vectors, it is possible to obtain smooth, frame-by-frame movements of the foreground image over the background image. By providing the composite image as a compressed standard format image, standard video output devices which natively support the compressed format may be used, allowing efficient storage and distribution of the data.

The image frames composed by the PC workstation **30** are supplied in digital form to a digital-to-analog converter **32** which, in turn, passes the analog signal to a VCR **34** or other video recording device.

In this embodiment, the PC workstation **30** operates with two applications programs namely, AVS 4000 and AVS 5000, which are also available from Targa Systems, Inc. These programs, which implement the method according to the present invention for automatically superimposing the head of a human subject on a body contained in an image frame, is described in detail in Example 2.

EXAMPLE 2

As shown in FIGS. **4***a* and **4***b*, the image of a human head is initially electronically scanned and then digitized, and a set of first digital representations defining a first image frame are stored in the frame store **28**. The operator of the PC workstation **30** next displays the image of the head **16** on the workstation CRT screen **36** and selects a suitable frame size **40** for the image. In addition, the workstation operator selects a reference point on the first image frame **40** which indicates the location of the head with respect to the frame. This reference point is preferably a central point at the bottom of the chin, in the case of a full-face view, and a central point at the top of the neck in the case of a side view. These reference points are shown as points **42** and **44**, respectively, in FIGS. **4***a* and **4***b*.

As a next step, the workstation operator causes the workstation to scale the image of the head, and produce and store digital representations of the head in a plurality of sizes, as shown in FIGS. **5***a* and **5***b*. Digital representations associated with each stored frame also define (1) the location of the reference point **42**, indicating the location of the head on this frame, and (2) the size of the head in this first frame.

EXAMPLE 3

The scanned, extracted and scaled image of the head may then be merged with an image of a body.

Digital representations of a picture containing the body of the human subject are scanned, e.g., by the flatbed scanner **26**, and entered into the frame store **28**. The image frame containing this body is also displayed on the CRT display by the operator of the PC workstation. By observing the image, the operator produces a set of digital representations associated with this image frame defining (1) a reference point **46** on the frame **44** specifying the desired location of the head on this frame, (2) the desired size of the head on this frame **44**.

Thereafter, the operator superimposes the image frame **40** containing the human head **16** in the desired size upon the image frame **44** with the reference point **42** superimposed upon the reference point **46**.

Finally, the superimposed images, so generated, are output, for example supplied to a digital-to-analog converter which converts the image to a single frame in NTSC format which is then recorded on a VCR **34**, or the image may be printed on a sheet.

EXAMPLE 4

FIGS. **8** and **9** illustrate how a voice recording may be generated to provide a custom tailored soundtrack for a video recording. In this example, digital representations of the name of a human subject, "JASON", is inserted in a pre-recorded and digitized soundtrack.

FIG. **8** represents an excerpt from a magnetically recorded soundtrack **50**. According to the present invention, the word "JASON" with the proper intonation, is inserted at the beginning and end of pre-recorded sentences.

FIG. **9** is a block diagram showing an apparatus for implementing the method. This system comprises a microphone **52**, analog-to-digital converter **54**, a PC computer workstation **56**, a digital-to-analog converter **58** and the VCR **34**. The PC workstation **56** contains an IBM audio capture and playback adapter with associated software.

The method of producing the voice recording of FIG. **8**, with the aid of the apparatus of FIG. **9**, will now be described.

Initially, the text of the voice recording, without the inserted name, is spoken into the microphone **52**. This text is recorded in digital form on the hard disk memory of the PC workstation. Thereafter, the name of a human subject, e.g., "JASON", is spoken into the microphone **52** with three different intonations: declaratory, exclamatory and interrogatory. These sounds are also digitized and stored on the workstation hard disk.

Preferably, an entire library of names is so recorded on the workstation hard disk for later use. Of course, different names may be synthesized by a computer system based on the pronunciation of the name and a voice synthesis algorithm. The audio sound track may also be processed on an Apple Macintosh computer with sound capability.

When a video cassette recording is made, the text is automatically read and supplied via the digital-to-analog converter **58** to the VCR **34**. Personal names, e.g., "JASON", with a proper intonation, are inserted in this text on the fly. If the name is to be added at the end of a sentence, digital representations thereof are added "flush left", i.e., with a variable length sound gap between the end of the sentence and the beginning of the next sentence; if it is to be inserted at the beginning of a sentence, the digital representations are added "flush right", i.e., with a variable length gap before the name, so that the sentence will sound "natural" in reproduction. The name may also be embedded in the sentence, with variable length gaps at pauses within or at the beginning and/or end of the sentence.

The audio may also be recorded, for example, into a semiconductor storage device, such as in compressed digital format in a electrically programmable read only memory device, e.g., a known EPROM or EEPROM device, or in an analog format in an analog storage device, such as is available from ISD. Thus, the audio may be provided in a portable electronic reproduction device to accompany a set of printed images.

EXAMPLE 5

As illustrated in FIG. **10**, the video and audio "personalization processes", respectively, according to the invention are carried out as follows:

Video Personalization:

First, a photograph of a child (any size) which includes a child's head—e.g., in full face view—is scanned using a color video scanner. That digitized image is saved using the Targa AVS 5000 software on a 486 PC workstation. (Block **60**).

After being saved, the image of the child's head is digitally "cut-out" using a computer tablet and the tablet's pointing device. The cutting-out is accomplished by tracing the edge of the child's head with a light pink line. This shade of pink has the ability to blend the edges of the child's head with the background colors in other illustrations or scenes ("background images"). (Block **62**).

The cut-out head is saved after pink pixels are added to the corners of the image ("foreground image"). These pixels are added because the heads are ultimately justified against the background images according to the bottom left-hand corner of the foreground image, and the pixels in the corner prevent differently oriented and sized heads from being automatically positioned incorrectly relative to the position of the illustrated body in the background image.

Next, using the PC workstation, the scanned-in head is automatically scaled to up to 30 different sizes, from small to large, each of which is saved as an individual foreground image with a distinct name (**F1, F2, F3**, etc.) to produce a file called "Faces". The head is in some cases also flipped (mirror imaged) and/or rotated. (Block **64**). Of course, with sufficiently powerful computing hardware, these images may be scaled "on-the-fly".

As a next step, using the PC workstation, the proper foreground image (**F1, F2, F3**, etc.) is retrieved from the file "Faces" and superimposed automatically upon the next successive background image of a video story (**ABC1, ABC2, ABC3**, etc.) at its proper location. Thereafter, the combined image is stored on a hard disk or directly to a video storage device, such as a VCR.

The first name of the person shown in the Faces file is written out as text and this text is inserted in those background images (**ABC1, ABC2**, etc.) that include the child's name. (Block **66**).

The presentation ("story") is now recorded from the hard drive of the PC workstation to a videotape (or other possible media in the future). The story consists of a sequence of video and audio elements (images, voice messages, music) that are played in a predetermined order to create the story. In that sequence, the background images with the superimposed heads will appear in their predetermined places to create a personalized videotape. (Block **70**).

Audio Personalization:

An audio file called "Names" is first produced, containing digitized recordings of the various names spoken by a voice artist. (Block **68**). Of course, a computer synthesized voice may be used, especially if it is tuned to sound human.

When the presentation is created, the appropriate name is inserted at the predetermined point in the story. The name is "justified", either right or left, so that it will be naturally spoken in the context of the sentences in which it appears, with no unwanted pause between the name and preceding or subsequent words, or at other portions of the soundtrack, and so that the soundtrack remains in synchronization with the video sequence. (Block **70**).

FIG. **11** illustrates how the personalized presentation is created (Block **70**) from the files of digital representations containing the foreground images ("Faces") **72**, the background images ("ABC") **74**, the voice file for "Names" ("N") **76**, the voice file for narrative ("ABCV") **78** and the music file ("ABCM") **80**. As explained above, the video presentation is created by superimposing the correct image of a head (**F1, F2, F3**, etc.) on successive background images **ABC1, ABC2, ABC3**, etc.

The audio presentation is created by superimposing digital representations of the names **N1, N2, N3**, etc. over the voice file **ABCV1, ABCV2, ABCV3**, etc. In addition, successive digital representations from the music file **ABCM1, ABCM2, ABCM3**, are supplied at proper intervals.

There results a presentation file **82** which is stored on the hard disk and then "played" through the digital-to-analog converter to a VCR to produce a videotape.

EXAMPLE 6

In contrast to the system described above, an alternative system is provided which allows the production to occur in real time and be synthesized, sequenced and directly recorded on a video tape **100** or other video recording device.

Thus, according to this embodiment, a source background video sequence may be provided on a master videotape, in a video tape player **101**. In each frame, a foreground image is supplied from a library of images in memory **102**, which may include images varying in perspective, size, action (e.g., mouth open, mouth closed, eyes open, eyes closed, smiling, frowning, etc.), lighting, or other characteristics. The image library may also be supplemented with synthesized images, which are interpolated or extrapolated from actual images.

The source background video sequence is coded with SMPTE time codes **103**, and may also have other associated information. For example, a close-captioned signal may be included with the audio text, and information regarding the optimum location and orientation of the image. The source background video image **104** is fed to a **486** PC computer **105** with a modified Television Laboratories Director Turbo system video processor. This video processor allows the facial image to be scaled, rotated and placed in real time on the background video image. The sequence of foreground images is determined by a predetermined program keyed to the SMPTE time codes **103**. Therefore, the processing of the foreground image proceeds in sequence, through a series of selections and transformations of the foreground image data.

The audio track **106** is processed by an Apple Macintosh computer **107**. Based on a preprogrammed sequence the SMPTE time codes **103** from the background video sequence control the audio system. At selected chronological locations within the audio sequence, the name of the child is inserted, with the proper intonation and timing. Based on the linguistic relationship of the inserted name, which will have a variable duration, to the remainder of the audio track, which will have a fixed timing, gaps may be added or reduced to maintain the appropriate synchronization. If close caption signals are provided, these may be updated with the child's name as well.

The fixed audio track is preferably recorded on an audio tape, separate from the source background video signal, with only the variable portion, i.e., the child's name, provided by the Apple Macintosh. Of course, the entire audio sequence, including both the fixed and variable portions, may be provided by the audio subsystem, separate from the video source, especially where more complex variable portions are provided, wherein the final production is provided based on the SMPTE time codes, synchronizing the audio and video in the layback process.

The SMPTE code may be either a longitudinal time code (LTC) or a vertical interval time code (VITC), although the LTC is preferred.

The library of images, stored in memory **102**, of the human subject as the foreground image may also be "morphed" with the background video image sequence, although this is not generally performed in real time, i.e. the background image cannot be directly transferred to the output videorecorder at about 30 frames per second, but rather at a much slower rate.

In the "morphing" process, the foreground human subject image, i.e., the facial image, is coded by hand or through an automated feature coding system, to separate the desired anatomical features from the remaining image components, and identify features, such as eyes, ears, nose, mouth, hair, and the like. The source background image is precoded for corresponding features. During production, frames are "morphed", especially in a manner which primarily preserves the characteristics of the foreground image for the primary facial features, and which preserves the background features at the edges and beyond, so that the resulting image of the human subject is an interpolation of a provided foreground image and a background image.

Further, the foreground image may be altered in expression, and, for example, lips from a still image may be made to appear to move.

EXAMPLE 7

The method according to Example 6 is implemented as follows:

First, an sequence of images of a human subject head is obtained by means of a video camera **14** or other electronic imaging system. These images differ in orientation and positioning, an a manner which is recorded in conjunction with the image. Therefore, a desired positioning and orientation for a cohesive match with the background image may be obtained by selecting the closest image actually obtained, which may then be further transformed by linear scaling, interpolation, or other processing. The subject stands on a turntable **18**, which turns about axis **20**. The rotation of the turntable **18** is controlled by a control **110**, which is interfaced to a synchronizer **111**, which also synchronizes a videotape recorder **24**, which receives a signal from a videocamera **14**, directed at the head **16** of the subject.

The human subject head is then separated from the remaining features either automatically or manually. For example, if the images are obtained in front of a blue screen, a chroma key unit may be used to provide a transparent margin for the foreground image. Alternatively, the edge of the head may be traced by an image processing algorithm to remove the remaining features. The separation may also be performed manually, as described above with respect to examples 1 and 2.

A unique positioning may be automatically determined for each image, e.g. **131–138**, for example by determining a central axis v and a point p, i.e., the lowest portion of the face, the chin, as shown in FIG. **13**. The size or scaling of the head may also be determined by measuring a distance from the bottom to top of the head, i.e., along the central axis, and relating this distance to a standard, as depicted in FIG. **12**. In FIG. **12**, a foreground image **121** is separated into a head portion **122**. A point p is determined which defines a positioning of the head **122**. The scaling of the head **122** is also determined by measuring a characteristic dimension x. The characteristic dimension x is related to a desired dimension y and the head rescaled to a new head image **123**. The background image **124** defines a background, as well as a desired positioning d and the desired scaling. The scaled foreground image **123** is merged with the background image **124** by superposing the scaled head **123** with the defined point of the scaled head **123** coinciding with the desired positioning d.

The positioning and scaling may also be manually determined.

A background graphic sequence is provided, preferably on an SMPTE coded videotape. A corresponding file includes information relating the SMPTE codes with desired positioning and scaling of the foreground image. The background image is then fed to a video processor, e.g., the aforementioned Television Laboratories Director Turbo system, where it is digitized and temporarily stored in a frame buffer. The video processor receives a selected foreground image, which is then scaled and positioned in real time. The foreground image is overlayed on the background image and output from the video processor as an NTSC signal, which is recorded on a video recorder.

Simultaneously with the video processing, the SMPTE codes are used to determine an audio track. A constant audio track is provided in synchronization with the background video. The SMPTE codes are fed to a Macintosh computer, which is preprogrammed to relate the sequence of audio. At particular times, a variable audio portion, i.e., a name, is inserted in the audio track. The predetermined sequence also includes information regarding the placement of the variable portion within the allotted timespace. Thus, the variable audio may be placed at the beginning, end, or middle of the timespace. The variable audio portion and the fixed audio portion are then mixed and recorded with the composite video on the video cassette recorder.

Of course, it should be understood that sequences of video buffer frames may also be present around the time occurrence a variable speech portion. Therefore, the length of the gap between fixed audio portions may be varied by truncating frames or by providing interpolated frames in the variable time portion, so that variable length sound gaps need not occur.

EXAMPLE 8

FIG. **16** shows a sheet of facial images **201**, **202** and **203** produced in accordance with the present invention. The printed images are preferably provided in a number of sizes, e.g., small **201**, medium **202** and large **203**, each having a standardized margin **204**, **205**, **206** allowing placement of the custom printed images **201**, **202**, **203** on an appropriate generic background image. The generic background images are included, for example, in a preprinted book or pamphlet, having images which are designed to accept the custom printed images to yield a composite image with an aesthetically pleasing result, or a plastic sheet having a background pattern on which die cut portions including the custom printed images on the sheet may be temporarily positioned and removed. The preprinted pages may, for example, have codes or outlines printed in places where particular images are intended to be placed, simplifying the process of selecting and placing a custom image which corresponds to the preprinted image.

It is also possible to provide computer software and printable sheets for use with a home computer, allowing the user to make the sheets themselves.

FIG. **17** shows a method in accordance with the present invention. A digitized image, including an object, is received by a processor **211**. The object may be, for example, an anatomical feature, or portion thereof, of a person or animal, such as the head, eyes, face, hands, limbs, etc., or other type of object, such as a plant, tree, building, car, boat, etc. The

object has at least one characteristic, which as discussed below, is determined. The digitized image is stored, at least temporarily, while further processing takes place, although the complete digitized image need not be stored permanently. The digitized image may be a single still frame, received from a scanned photograph or electronic camera, or a series of images, such as a video, digital video or cinema image stream.

The object is then extracted from the digitized image **212**. This extraction may be manual or semiautomatic, directed by a user, who identifies the object or the margins of the object, or participates in a selection procedure which identifies the object in one or more frames. The extraction may also be highly automated, using logic and/or artificial intelligence to identify the object and extract it from the image. Where the digital image is a single frame, the object extraction may be a simple two-dimensional image analysis. However, where the digital image comprises a number of frames, separated in time and/or space, the object extraction is preferably a more complex three or four dimensional image analysis. Where the input stream is video data, a calculated motion vector component may advantageously be used to separate a foreground object from a background image. Pattern recognition techniques may also be used to extract the object. The extracted object may also include modeling data, relating to characteristics not directly apparent or present in the digitized image.

A characteristic of the object is then determined **213**, based on the digitized image and/or the extracted object. For example, this characteristic may be a size, shape, scaling, rotation, translation, hue, brightness, gradient of hue or brightness, other color space characteristic, object identification, type, or the like.

The extracted object is stored **214**, e.g., sufficient data is maintained in a persistent manner to allow reconstruction of the object or an image thereof at a later time.

The system is provided with a parameter for modifying the characteristic of the object **215**. This parameter may be static or change for each object, and indeed there may be a plurality of parameters which may be applied individually or in groups, in one or more instances, to the object. Each parameter may be dimensionless, a simple vector or a more complex matrix.

The modification or modifications are then applied to the object, based on the parameter **216**, to generate representations of one or more modified objects. Generally, the modified objects will be stored in memory for later processing or output, although the object may also be processed or rendered in real-time and not stored as such.

The modified image of the object is then output **217**. The output device is generally a printer, such as an ink-jet, laser (toner based), dye sublimation, thermal transfer, or wax deposition printer, or an analog or digital electronic image output. Of course, the output may also be a computer aided manufacturing system to produce a relief or three dimensional object, a laser imaging system, a holographic imaging system, or other known type. In one embodiment, the image of the object is output onto a plastic film which is self-supporting, and has adhesion characteristics without the use of an added adhesive.

In this manner, customized image outputs may be automatically or semiautomatically produced from non-standardized input images.

There has thus been shown and described a novel method and apparatus for producing customized images which fulfills all the objects and advantages sought therefor. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to those skilled in the art after considering this specification and the accompanying drawings which disclose the preferred embodiments thereof. These images may be used by children or adults, and for novelty, business or educational purposes. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention, which is to be limited only by the claims which follow.

What is claimed is:

1. A method of producing an electronic image of a subject, said method comprising the steps of:

(a) providing an electronic representation of a pixel image of a head of said subject from an external source;

(b) providing a background image containing a body configured to adjoin said head;

(c) producing, from the electronic representation, a set of digital representations defining an actual size of said head in said electronic representation;

(d) providing a set of digital representations defining a desired size of said head corresponding to said body;

(e) processing said electronic representation of said image of said head in dependence upon the size information defined by said actual size and said desired size, representing said scanned image of said head scaled to said desired size; and

(f) outputting said head, electronically rescaled to said desired size, superposed on said body.

2. The method according to claim **1**, wherein said head has a reference vector and said body has a reference vector, further comprising the step of combining said head and said body to obtain a predetermined multidimensional relationship of the respective reference vectors of said head and said body.

3. The method according to claim **2**, wherein said providing an electronic representation of an image of a head of a subject step includes the steps of obtaining store images of said head from a plurality of perspectives, thereby to produce a plurality of electronic representations, with each of said electronic representations representing said head in a different angular position with respect to a vertical axis; wherein said reference vector of said head comprises an orientation parameter.

4. The method according to claim **1**, further comprising the step of defining a reference point of said electronic representation of said pixel image of said head of said subject, wherein said body has an associated reference point, further comprising the step of combining said head and said body to obtain a predetermined relationship of the respective reference points of said head and said body.

5. The method according to claim **4**, wherein said head includes a chin and wherein said reference point of said head is located substantially on said chin.

6. The method according to claim **4**, wherein said head includes a neck, and wherein said reference point is located substantially on said neck.

7. The method according to claim **1**, further comprising the steps of:

(g) providing a second image containing a second body configured to join said head;

(h) providing a second set of digital representations defining a second desired size of said head corresponding to said body of said second image;

(i) processing said electronic representation of said image of said head in dependence upon the size information

defined by said actual size and said second desired size, representing scanned image of said head scaled to said second desired size; and

(j) outputting said head, electronically rescaled to said second desired size, superposed on said body.

8. The method according to claim **1**, wherein said outputting step comprises generating said processed electronic representation as a composite video image of said scanned image of said head scaled to said desired size.

9. The method according to claim **1**, wherein colors in said image of said head are altered in correspondence to said colors of said drawing.

10. The method according to claim **1**, wherein said body includes a collar immediately adjacent to a location of said superimposed head.

11. The method according to claim **1**, further comprising the step of producing an audio recording associated with said processed electronic representation, said recording including a sequence of spoken words, having inserted therein a sound including a name of a person.

12. The method according to claim **1**, further comprising the step of extracting positional information from said image of said head, and wherein said outputting step further comprises outputting said head having a positional predetermined relation to said body based on said positional information.

13. The method according to claim **1**, further comprising the steps of:

(g) providing a plurality of images each having a representation of a body and a corresponding desired size of an associated head;

(h) processing said electronic representation of said image of said head a plurality of times in dependence on the size information defined by the actual size and the desired size relating to said plurality of representations of a body;

(i) extracting positional information from said image of said head; and

(j) said outputting step comprising outputting, in a plurality of images, for each representation of a body, said processed electronic representation as an image of said head rescaled to said desired size and having a predetermined relation to said respective body based on said positional information.

14. The method according to claim **13**, further comprising the step of associating with each of said plurality of output images, an audio stream, comprising a first portion associated with an identification of said head and a second portion associated with said body, said first and second portions having a predetermined temporal relationship.

15. The method according to claim **1**, further comprising the step of associating said outputted image with an audio stream, said audio stream comprising a first portion associated with an identification of said head and a second portion associated with said body, said first and second portions having a predetermined temporal relationship.

16. A method of producing a composite electronic image of a subject comprising the steps of:

(a) obtaining a first image and extracting information relating to a head of a subject from the image, and producing a set of first representations of the first image;

(b) producing a set of size representations associated with the first image information defining an actual size of the head;

(c) providing a normalized size parameter associated with a body;

(d) digitally converting the set of first representations of the first image into a set of second representations, in dependence upon the normalized size parameter, the set of second representations defining the head rescaled to the desired size; and

(e) outputting the head, anatomically superposed on said body, as image data.

17. The method according to claim **16**, further comprising the step of associating with said outputted image an audio stream, comprising a first portion associated with an identity of said head of said subject and a second portion associated with said body, said first and second audio portions having a predetermined temporal relationship.

18. The method according to claim **16**, further comprising the step of extracting positional information from said image of said head, and wherein said outputting step further comprises outputting said set of second representations in conjunction with said body and having a natural relation to said body based on said positional information.

19. A method of producing a composite image of a subject comprising the steps of:

(a) receiving a raster electronic image of a subject and extracting from the image an anatomical portion of the subject, from a remainder of the image;

(b) associating a reference with the extracted anatomical portion to define an anatomical location;

(c) determining a size of the extracted anatomical portion based on a determined actual size of the extracted anatomical portion;

(c) superimposing the extracted anatomical portion on top of a first predetermined image including an anatomically adjoining portion and a background graphic, to provide an anatomically correct juxtaposition of the anatomical portion with the anatomically adjoining portion overlying the background graphic, wherein the juxtaposition is based on the associated reference and the anatomical portion is normalized in size to the anatomically adjoining portion based on a first normalization parameter associated with the first predetermined image;

(d) outputting the juxtaposed anatomical portion with the first predetermined image as a composite image.

20. The method according to claim **19**, wherein the anatomical portion is a head of the subject.

21. The method according to claim **19**, further comprising the steps of:

superimposing the extracted anatomical portion on top of a second predetermined image, including an anatomically adjoining portion and a background graphic, to provide an anatomically correct juxtaposition of the anatomical portion with the anatomically adjoining portion overlying the background graphic, wherein the juxtaposition is based on the associated reference and the anatomical portion is normalized in size to the anatomically adjoining portion based on a second normalization parameter associated with the second predetermined image, wherein the first and second normalization parameters are different; and

outputting the superimposed anatomical portion with the second predetermined image as a composite image.

22. The method according to claim **21**, wherein said outputting step comprises printing the composite image on a recording medium.

23. The method according to claim **21**, wherein said outputting step comprises generating the composite image as a video signal.

24. The method according to claim 21, further comprising the step of associating said outputted image with an audio stream, the audio stream comprising a first portion associated with an identification of the subject and a second portion associated with the first image, said first and second portions having a predetermined temporal relationship.

25. The method according to claim 21, wherein the first predetermined image comprises a buffer zone that visually obscures misalignment and visual artifacts from superimposition of the extracted anatomical portion.

26. A method of producing a composite electronic image of a subject comprising the steps of:

(a) obtaining a first image of a subject and separating information relating to a first anatomical portion of the subject from a remainder of the first image, and producing a set of first representations of the first anatomical portion of the subject;

(b) producing a set of digital representations associated with the first image, defining an actual size and anatomical orientation of the first anatomical portion;

(c) providing normalization parameters, the normalization parameters representing a size and anatomical positioning of a predetermined image, the predetermined image comprising an anatomically adjoining part;

(d) converting the set of first representations of the first image into a set of second representations, in dependence upon the normalization parameters and the set of digital representations, the set of second representations defining the first anatomical portion rescaled and reoriented to adjoin the anatomically adjoining part;

(e) superimposing the set of second representations into the predetermined image in anatomically correct juxtaposition with the anatomically adjoining part; and

(f) outputting the second representations superimposed on the predetermined image as image data.

27. A method of producing an electronic audio program, said method comprising the steps of:

(a) providing an electronic representation of a customizable audio program, having a set of predetermined insertion points and associated context;

(b) providing an electronic representation of a variable audio program portion from an external source;

(c) producing a set of digital representations defining a duration of the variable audio program;

(d) merging the customizable audio program and the variable audio program while time-justifying the variable audio program within the customizable audio program based on the predetermined insertion points and associated context, to produce a natural speech pattern; and

(e) outputting the merged audio program.

* * * * *

Exhibit B

US005623587A

United States Patent [19]

Bulman

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[45] Date of Patent: Apr. 22, 1997

[54] **METHOD AND APPARATUS FOR PRODUCING AN ELECTRONIC IMAGE**

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[21] Appl. No.: **489,564**

[22] Filed: **Jun. 12, 1995**

Related U.S. Application Data

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[51] **Int. Cl.**[6] **G06F 15/00**

[52] **U.S. Cl.** **395/135**

[58] **Field of Search** 395/135, 155, 395/161; 345/113, 114

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Attorney, Agent, or Firm—Furgang & Milde, LLP

[57] **ABSTRACT**

A method for producing a composite electronic image of a subject comprises the steps of converting a set of representations of the first images into an another set of representations of the first image which are dependent upon the size information defined by the representations of the foreground and background frames; and combining the converted images with the foreground image using the reference points. This method can also be used to combine the sound data and a sequence of frame images.

36 Claims, 12 Drawing Sheets

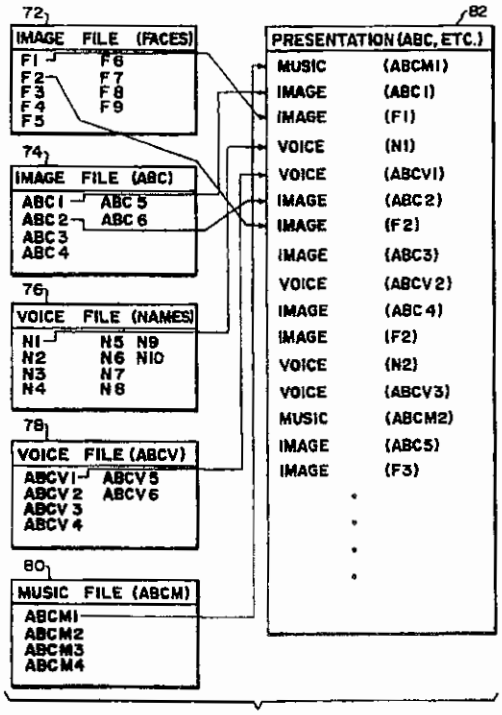


FIG.1

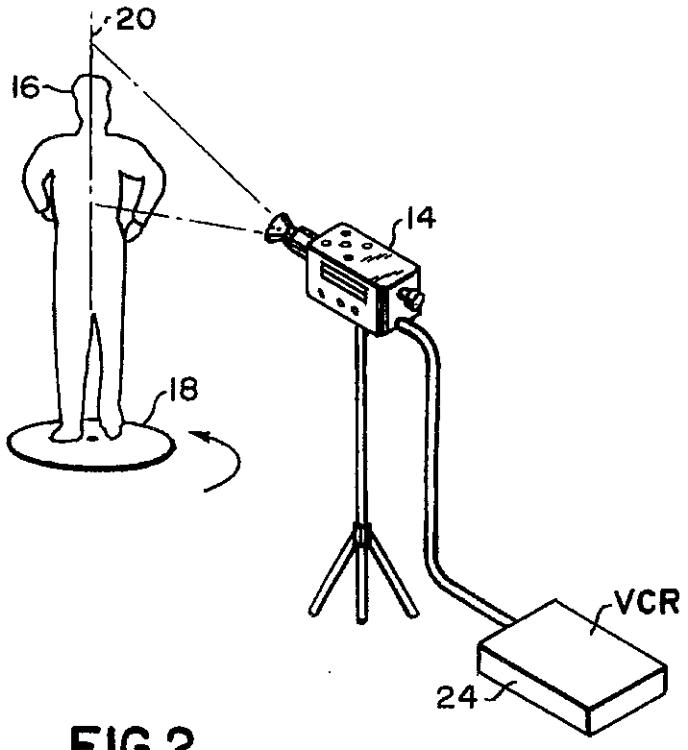


FIG.2

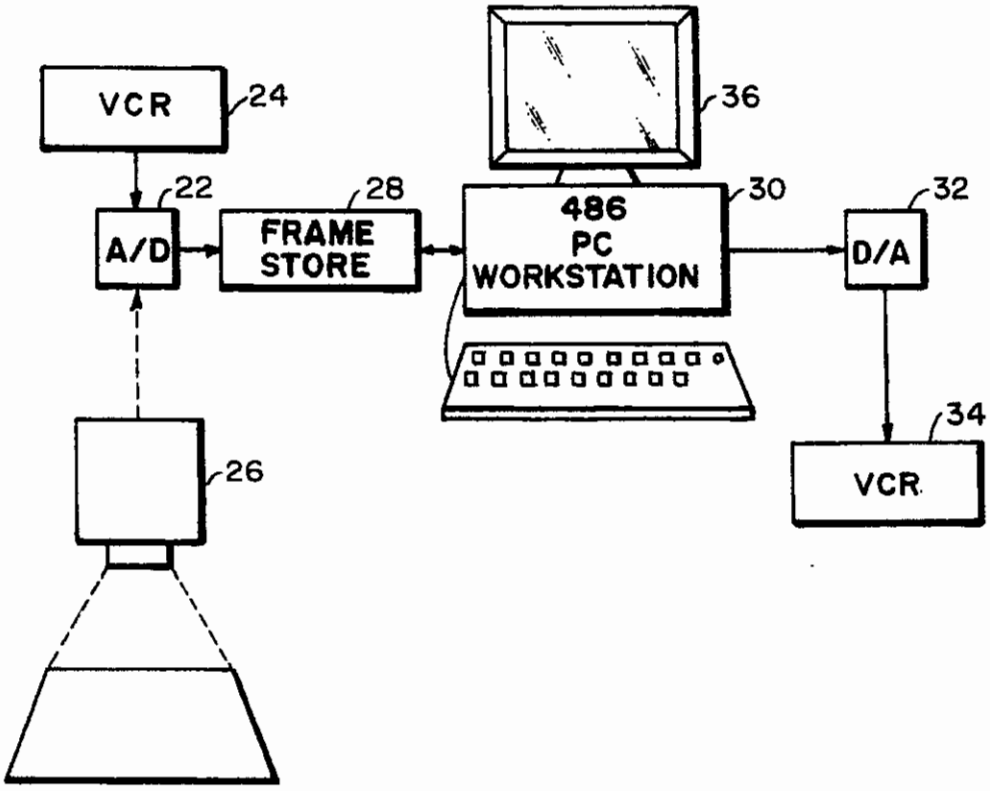


FIG.3

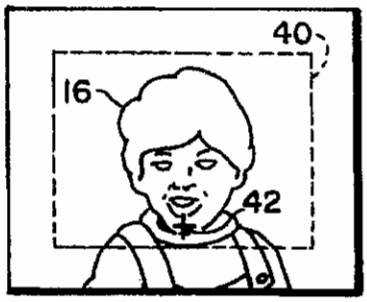


FIG.4A

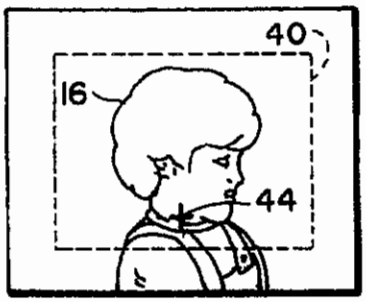


FIG.4B

FIG.5A

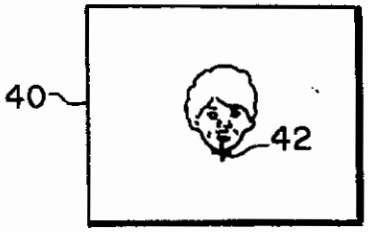


FIG.5B

FIG.6

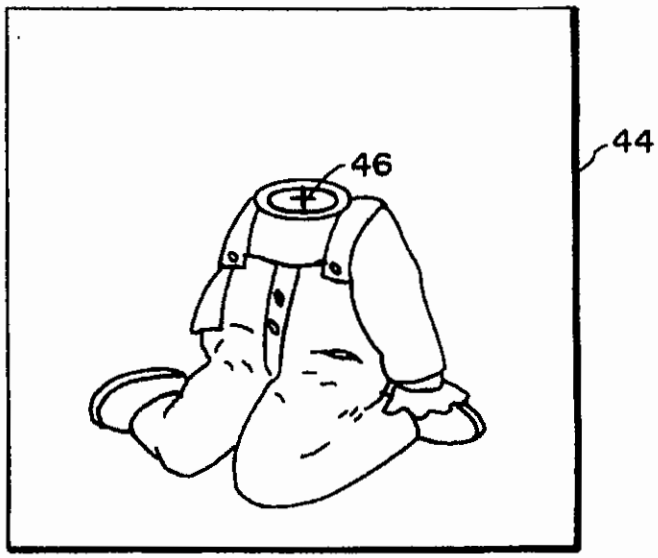
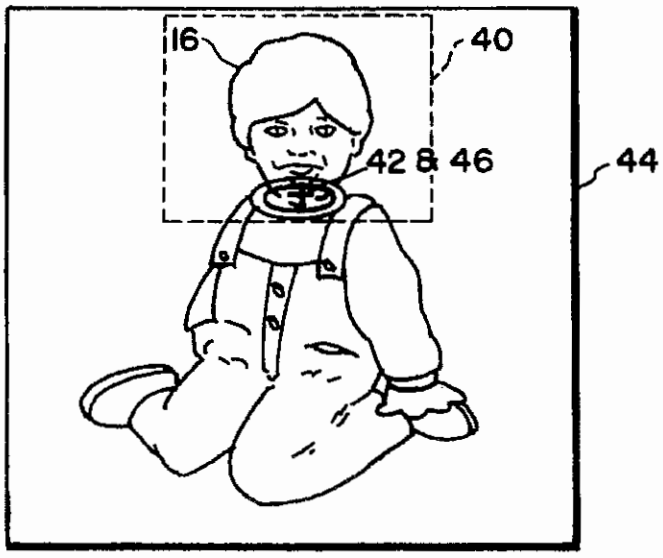


FIG.7



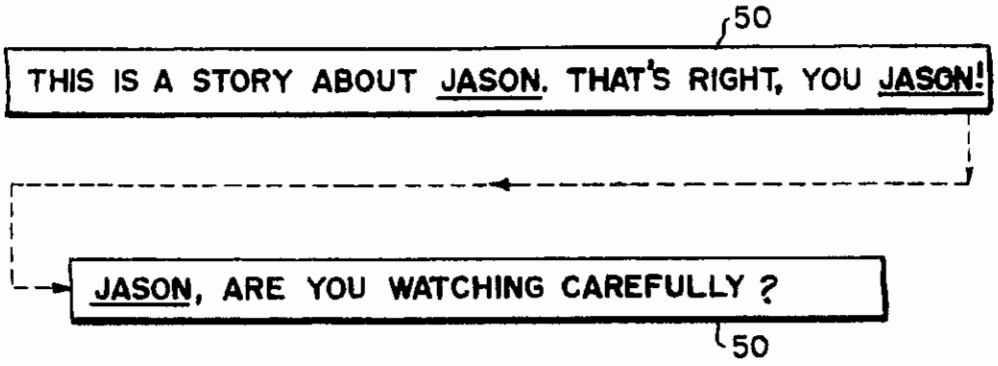

50
THIS IS A STORY ABOUT JASON. THAT'S RIGHT, YOU JASON!
JASON, ARE YOU WATCHING CAREFULLY ?
50

FIG.8

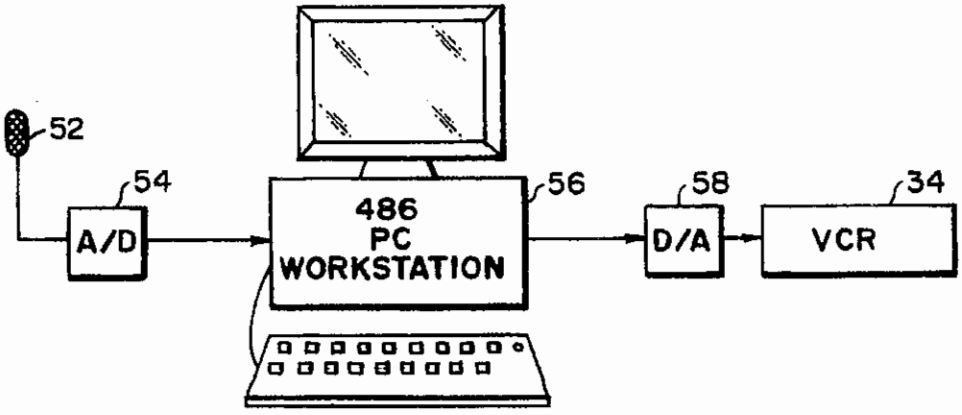

52
54
A/D
486
PC
WORKSTATION
56
58
D/A
34
VCR

FIG.9

FIG.10

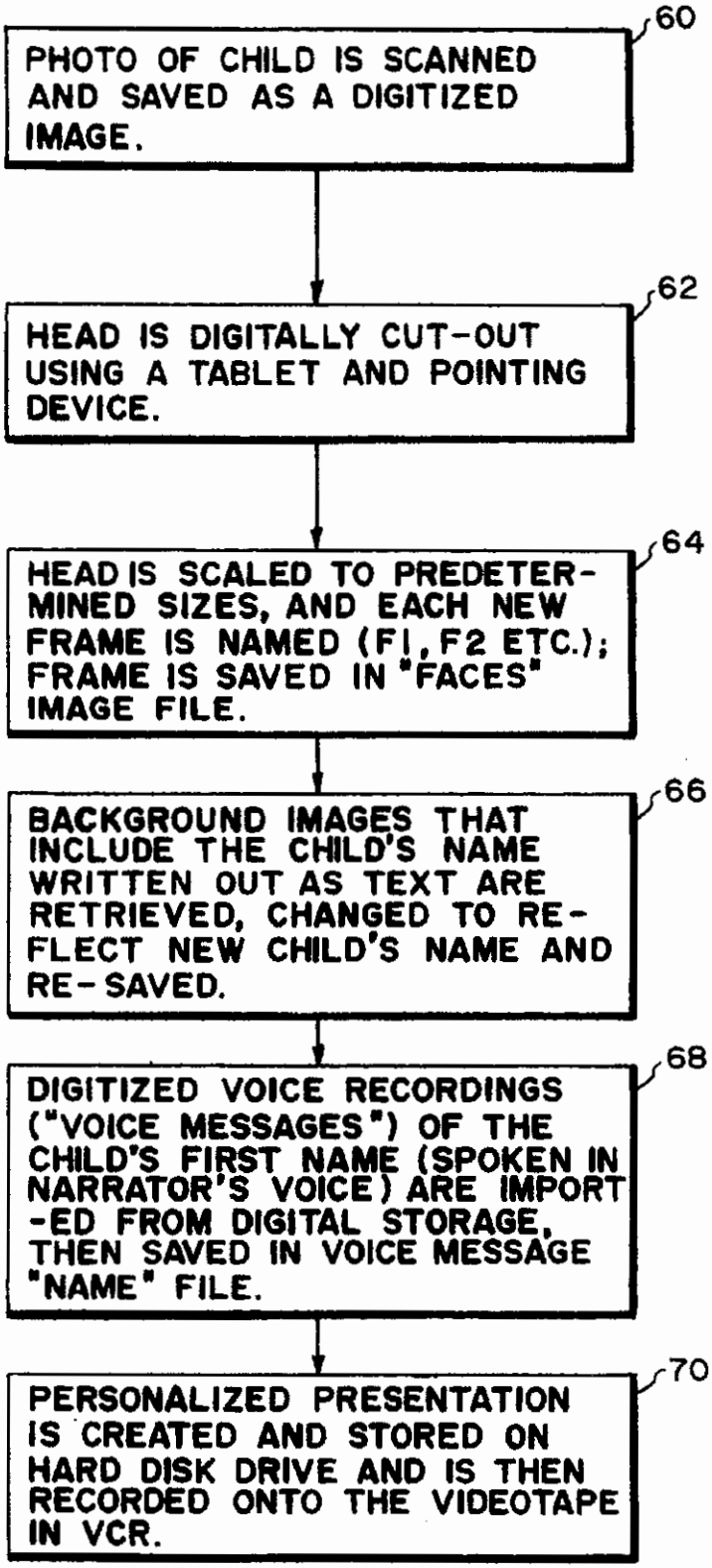
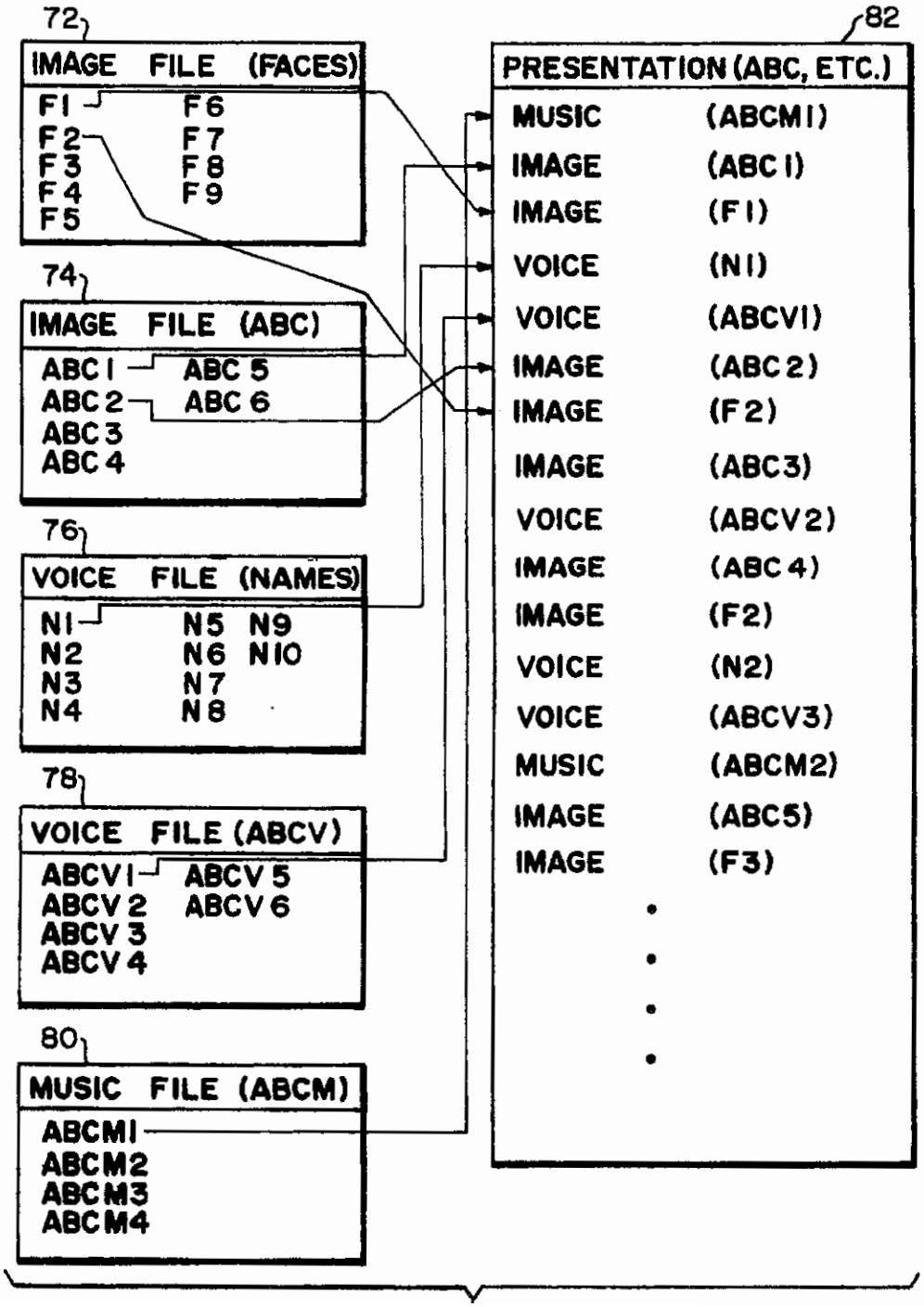

60
PHOTO OF CHILD IS SCANNED AND SAVED AS A DIGITIZED IMAGE.
62
HEAD IS DIGITALLY CUT-OUT USING A TABLET AND POINTING DEVICE.
64
HEAD IS SCALED TO PREDETERMINED SIZES, AND EACH NEW FRAME IS NAMED (F1, F2 ETC.); FRAME IS SAVED IN "FACES" IMAGE FILE.
66
BACKGROUND IMAGES THAT INCLUDE THE CHILD'S NAME WRITTEN OUT AS TEXT ARE RETRIEVED, CHANGED TO REFLECT NEW CHILD'S NAME AND RE-SAVED.
68
DIGITIZED VOICE RECORDINGS ("VOICE MESSAGES") OF THE CHILD'S FIRST NAME (SPOKEN IN NARRATOR'S VOICE) ARE IMPORTED FROM DIGITAL STORAGE, THEN SAVED IN VOICE MESSAGE "NAME" FILE.
70
PERSONALIZED PRESENTATION IS CREATED AND STORED ON HARD DISK DRIVE AND IS THEN RECORDED ONTO THE VIDEOTAPE IN VCR.

FIG.11


72
IMAGE FILE (FACES)
F1 F6
F2 F7
F3 F8
F4 F9
F5
74
IMAGE FILE (ABC)
ABC1 ABC5
ABC2 ABC6
ABC3
ABC4
76
VOICE FILE (NAMES)
N1 N5 N9
N2 N6 N10
N3 N7
N4 N8
78
VOICE FILE (ABCV)
ABCV1 ABCV5
ABCV2 ABCV6
ABCV3
ABCV4
80
MUSIC FILE (ABCM)
ABCM1
ABCM2
ABCM3
ABCM4
82
PRESENTATION (ABC, ETC.)
MUSIC (ABCM1)
IMAGE (ABC1)
IMAGE (F1)
VOICE (N1)
VOICE (ABCV1)
IMAGE (ABC2)
IMAGE (F2)
IMAGE (ABC3)
VOICE (ABCV2)
IMAGE (ABC4)
IMAGE (F2)
VOICE (N2)
VOICE (ABCV3)
MUSIC (ABCM2)
IMAGE (ABC5)
IMAGE (F3)

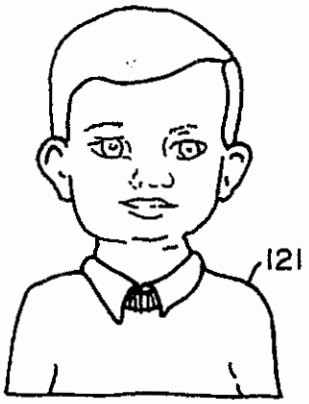


FIG.12A

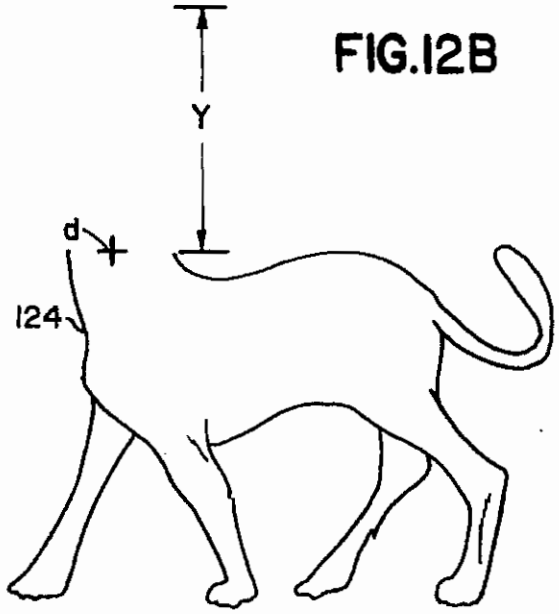


FIG.12B

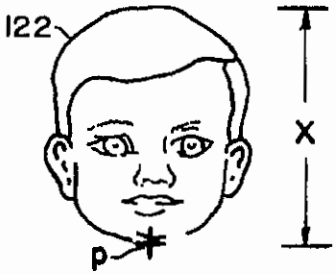


FIG.12C

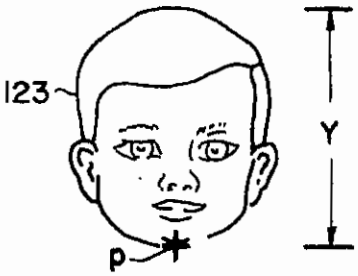


FIG.12D

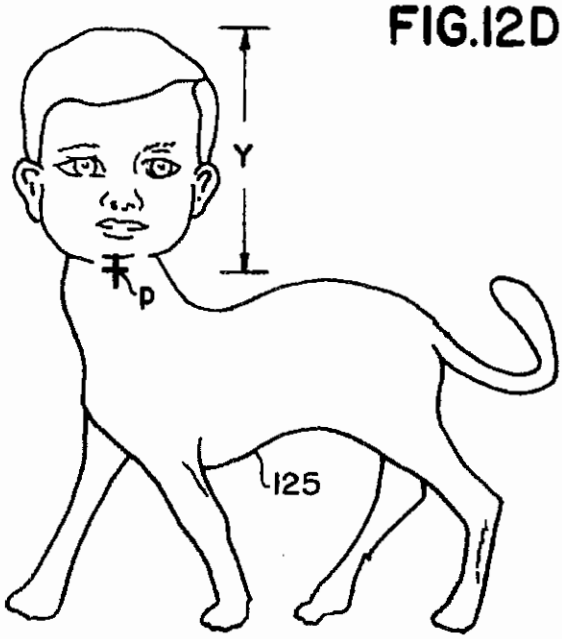


FIG.12E

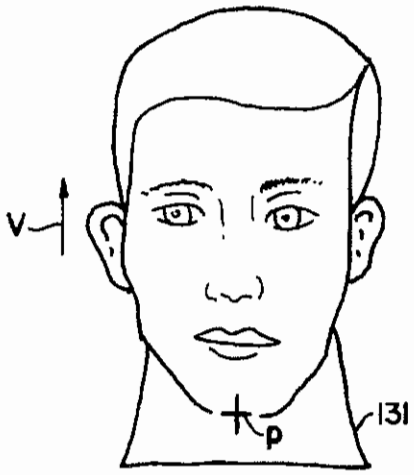


FIG.13A

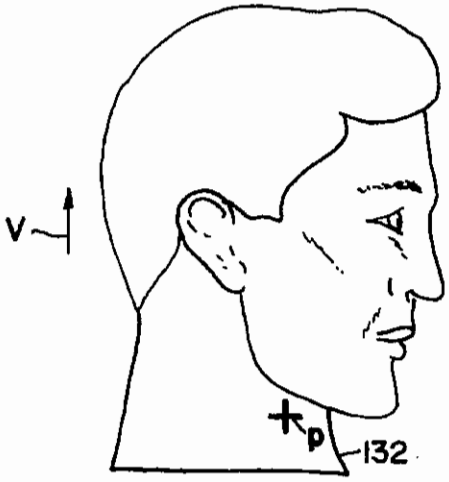


FIG.13B

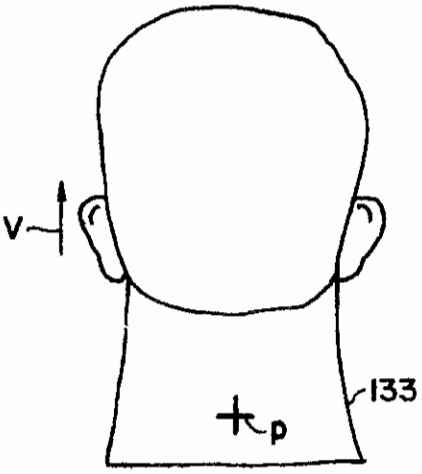


FIG.13C

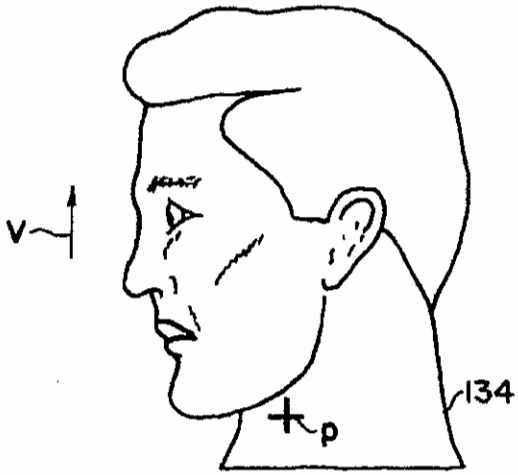


FIG.13D

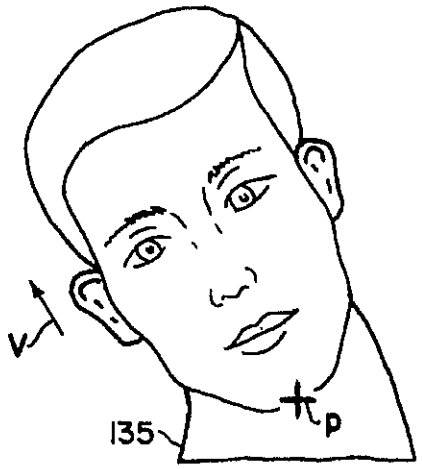


FIG.13E

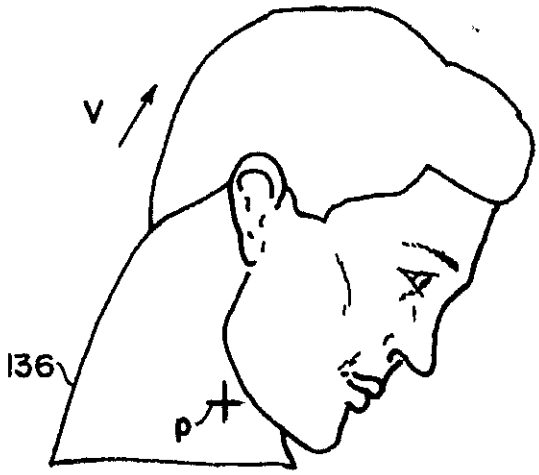


FIG.13F

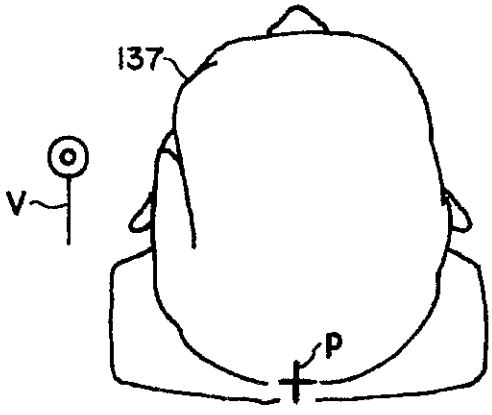


FIG.13G

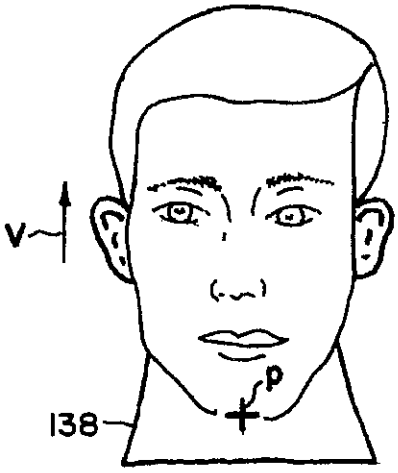
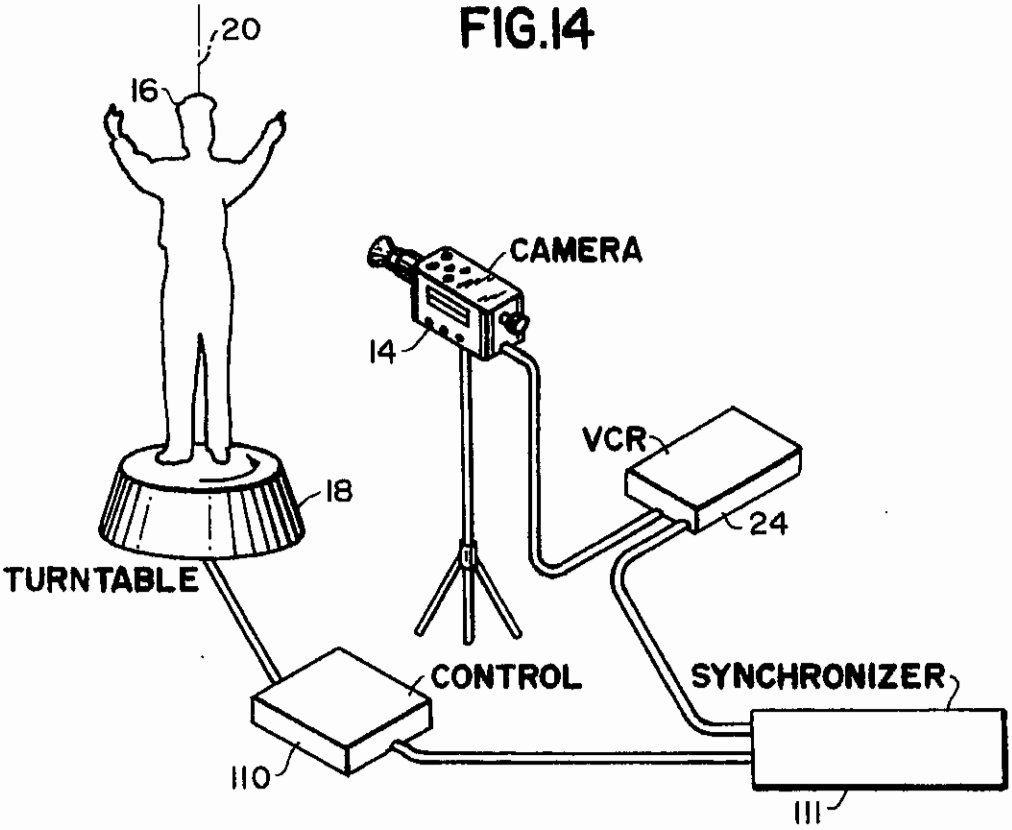


FIG.13H

FIG.14


20
16
CAMERA
14
VCR
24
18
TURNTABLE
CONTROL
SYNCHRONIZER
110
111

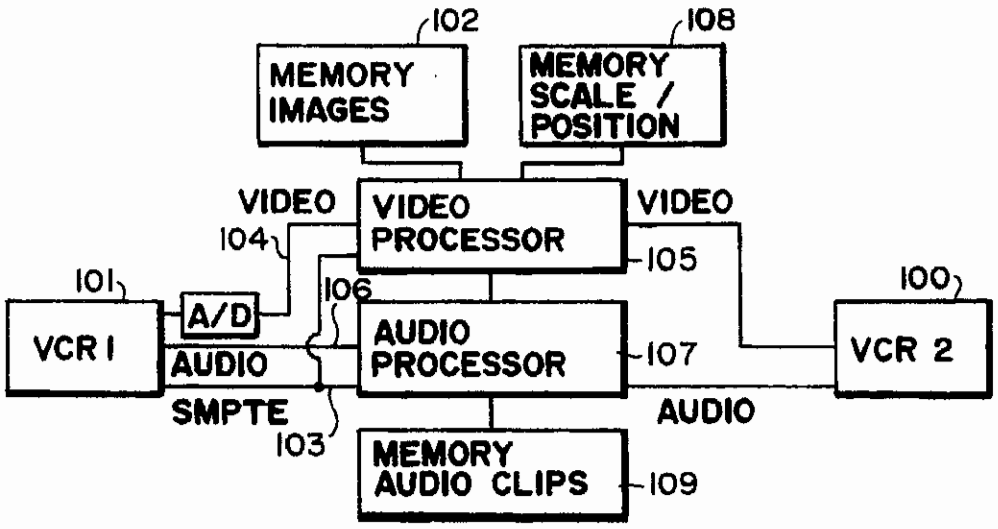

102
MEMORY IMAGES
108
MEMORY SCALE / POSITION
VIDEO
104
VIDEO PROCESSOR
VIDEO
105
101
A/D
106
100
VCR 1
AUDIO
AUDIO PROCESSOR
107
VCR 2
SMPTE
103
AUDIO
MEMORY AUDIO CLIPS
109

FIG.15

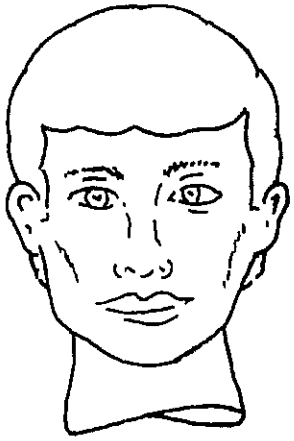


FIG.16A

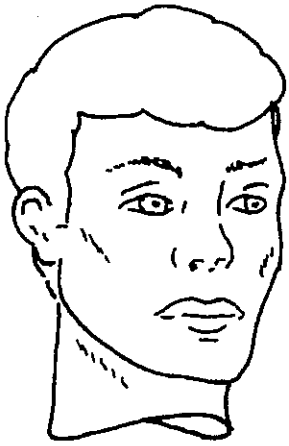


FIG.16B

FIG.16C

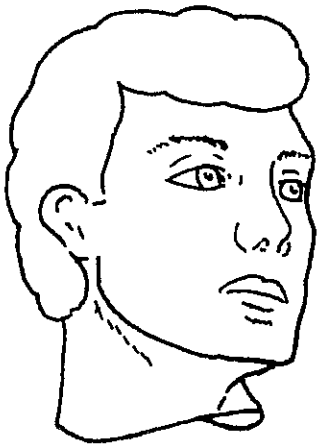


FIG.16D

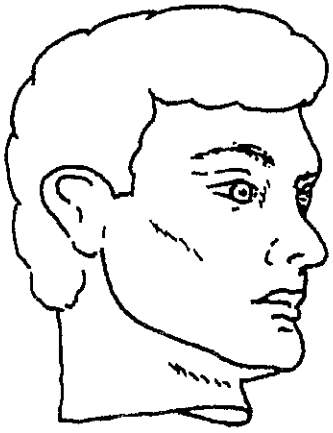


FIG.16E

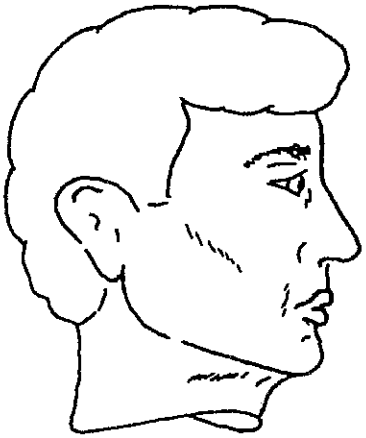


FIG.17A

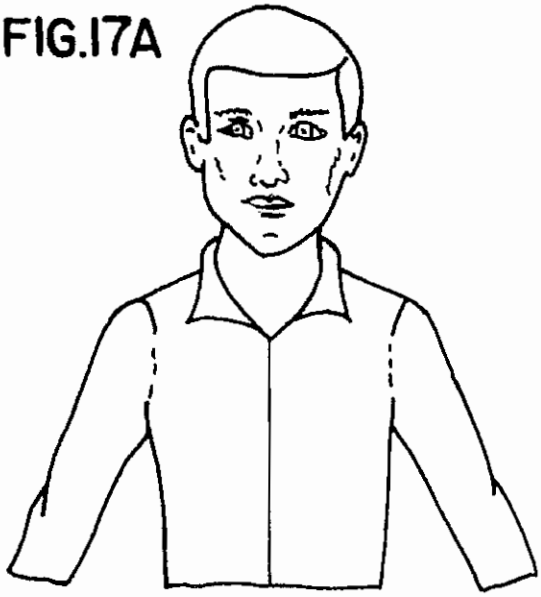


FIG.17B

FIG.17C

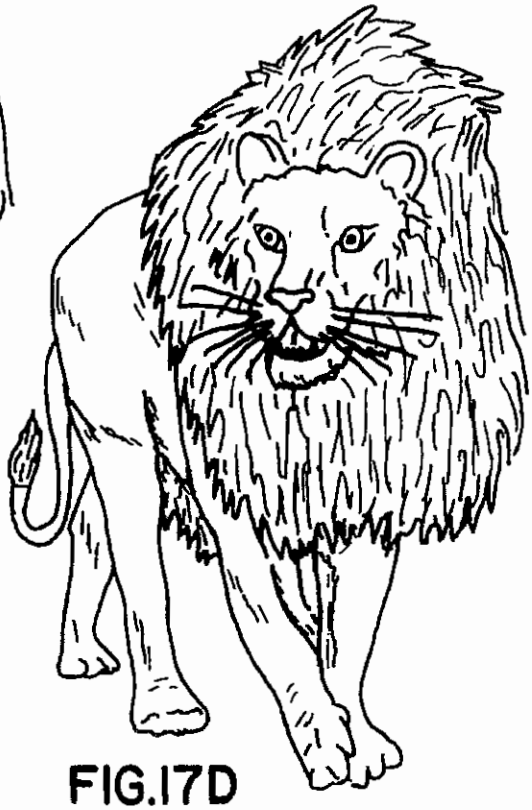


FIG.17D

METHOD AND APPARATUS FOR PRODUCING AN ELECTRONIC IMAGE

REFERENCE TO RELATED APPLICATIONS

The present application is a Continuation-in-part of U.S. patent application Ser. No. 08/138,531, filed Oct. 15, 1993, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for producing a series of electronic images of an animated figure having at least two body portions, wherein a first body portion from one source is automatically combined in anatomically appropriate fashion with a second body portion from the same or different source. The series of electronic images are then further combined with other images.

In the following description, the term "head" is intended to include not only the head of a human being with its hair (however long) face, ears, etc., but also any and all appurtenant accessories such as a hat, glasses, hair adornments, jewelry (earrings, etc.) and the like. The term "body" as it is used herein, is intended to include the body of a human being, animal, fish, etc., (either real or fictional, animated or photorealistic) including not only the torso, arms, legs, tail, fins, etc., but also any and all appurtenant clothing, shoes, jewelry, and the like. The image of the head and/or body may be obtained from a "real" head or body, respectively, either photographically or by electronic image scanning, or from an artistic or computer generated rendering thereof.

It is known to produce pictures of human subjects with the head of one human being superimposed upon the body of another human being, animal, fish, etc. This superposition is normally accomplished "mechanically" by cutting around the outline of the head of a person shown in a first photograph and applying this head, in the proper position and orientation, to a body in a second photograph. The resulting "mechanical" is thereafter photographed and/or scanned electronically to produce a third photograph or electronic image. Electronic implementation of this process is also known, where the head is electronically traced and superimposed.

This superposition process is time consuming and requires that the head and body in the first and second photographs, respectively, be adjusted in scale photographically; that is, that either the first or second photograph be enlarged or reduced so that the head and body are of the same relative size.

Consequently, this superposition process is only rarely used, and when used it is limited to situations where the cost of the process is small compared to the cost of the overall desired product.

Steir et al., U.S. Pat. No. 5,060,171 relates to a system for superimposing images. A video image of a head is captured. This image is apparently processed as a static single frame, and a separate hairstyle is overlayed with a translation and scaling transform. The system does not provide for dynamically merging a first image with a second image which changes. See also, U.S. Pat. No. 5,289,568.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a method and apparatus for producing an electronic image of an animated subject in which the head of one subject is automatically superimposed upon the body of another subject, which may be a person, animal, fish, etc.

It is a further object of the present invention to provide a method and apparatus for producing an electronic image of a combination of a head from one subject and a body from another subject, which is substantially less time consuming and less costly than the superposition process known heretofore.

These objects, as well as further objects which will become apparent from the discussion that follows, are achieved, in accordance with one embodiment of the present invention, by a method, and by apparatus for carrying out a method, which comprises the steps of:

(a) electronically inputting a first image of at least a portion of said subject and storing a set of first digital representations defining said first image in a foreground electronic image frame;

(b) generating a plurality of second images of a picture containing a remainder portion of said subject and storing a plurality of sets of second digital representations, each set defining one of said second images in a background electronic image frame;

(c) producing a set of third digital representations associated with said foreground frame defining (1) a first reference point on said foreground frame indicating the location of said subject portion in said foreground frame, and (2) the size of said subject portion in said foreground frame;

(d) producing a set of fourth digital representations associated with each of said background frames defining (1) a second reference point on each respective background frame specifying the desired position of said subject portion in said background frame, and (2) the desired size of said subject portion in each respective background frame;

(e) converting said set of first representations of said first image into a plurality of sets of fifth representations, in dependence upon the size information defined by said set of third representations and said plurality of sets of fourth representations, each set of said fifth representations defining said foreground frame with said subject portion scaled to said desired size and located at said desired position in a respective one of said background frames;

(f) combining said set of fifth representations defining said foreground frame upon said set of second representations defining said background frame such that said first and second reference points substantially coincide, to produce a plurality of sets of sixth digital representations, each defining a respective final electronic image frame containing said subject portion disposed upon said remainder of said subject at said desired position and with said desired size; and

(g) storing said plurality of said sets of said sixth digital representations to provide a sequence of said final frames. Optionally, an accompanying sound sequence may be provided by:

(h) storing a sound sequence associated with said sequence of final frames; and

(i) producing a video recording comprising said sequence of final flames and said associated sound sequence.

In accordance with a second embodiment of the present invention, a method and apparatus for carrying out a method, is provided which comprises the steps of:

(a) obtaining first image information relating to a first anatomical portion of a subject and producing a set of first representations of the first image;

(b) obtaining second image information relating to a second anatomical portion of a subject and producing a set of second representations of the second image defining a plurality of second image frames, the first anatomical portion being for placement adjacent the second anatomical portion;

(c) producing a set of third representations associated with the first image information defining (1) a first reference indicating a positioning of the first anatomical portion, and (2) a size of the first anatomical portion;

(d) determining a set of fourth representations associated with the plurality of second frames defining (1) a second reference on each of said second flames specifying the desired positioning for the first anatomical portion in said respective second frame, and (2) the desired size for the first anatomical portion in said respective second frame;

(c) converting the set of first representations of the first image into a set of fifth representations, in dependence upon the third and fourth representations, the fifth representations defining the first anatomical portion scaled to the desired size and with the desired positioning;

(f) merging the set of fifth representations with the set of second representations defining a respective second frame such that the first and second references substantially coincide, to produce a set of sixth representations defining a respective second image frame comprising the first anatomical portion disposed adjoining the second anatomical portion with the desired positioning and of the desired size; and

(g) outputting the respective second image frame from the set of sixth representations.

Also provided is a method comprising the steps of:

(a) electronically scanning a first image of a head of said subject and producing a set of first digital representations of said first image defining a first electronic image frame;

(b) generating a plurality of second images containing a body for said subject and producing a set of second digital representations of said plurality of second images defining a plurality of second electronic image frames;

(c) producing a set of third digital representations associated with said first frame defining (1) a first reference point on said first frame indicating the given location of said head in said first frame, and (2) the size of said head in said first frame;

(d) producing a set of fourth digital representations associated with each of said plurality of second frames each respectively defining (1) a second reference point specifying a desired location of said head in said second frame, and (2) a desired size of said head in said second frame;

(e) converting said set of first representations of said first image into a set of fifth representations, in dependence upon the size information defined by said third and fourth representations, said fifth representations defining said first frame with head scaled to said desired size and located at said given position;

(f) merging said set of fifth representations defining said first frame with said set of second representations defining said plurality of second frames such that said first and second reference points substantially coincide, to produce a set of sixth digital representations defining a plurality of third image frames of a picture containing said head dynamically disposed upon each of said body portions of said second images at said desired location; and

(g) outputting said plurality of third image frames from said set of sixth representations.

In the preferred embodiment according to the present invention, the first anatomical portion of a subject is a head and the second anatomical portion is a body, preferably derived from different sources, e.g., the head portion is from a different entity than the body portion. The first image information is obtained either through a video or electronic camera from scanning one or more still pictures. Alternatively, an artist may produce a drawing or caricature of the head and/or body portions, either directly with an electronic capture system or using standard artistic media which is later input into the computer system by scanning or other imaging process. The second image comprises an animated sequence, a videotape, a series of still scenes, or computer generated background scenes. The second image preferably has an anatomical adjoining part which allows normal appearing placement of the anatomical part of the first image, or includes a buffer zone which obscures misalignment or other visual artifacts from the merging process. Alternatively, the second image includes only the second anatomical portion, e.g., body, which is electronically joined with the first anatomical portion, e.g., head, and the joined first and second images are together superimposed on a background.

In general, an audio sequence will accompany the images, which will be a fixed sequence or a prototype sequence altered based on particular added information, such as a name, identification, or other contextual information. The audio sequence corresponds to the image sequence.

The resulting multimedia sequence will therefore include exemplar material in both the video and audio sequences, which has been modified and/or customized based on individualized inputs. Because the exemplar material may comprise the bulk of the production content, this system allows and facilitates customization of multimedia productions with a relatively small customization information input. Further, because the production may be modularized, with one or more levels of customization, a high degree of flexibility is available for relatively low cost per custom multimedia production. Thus, each output multimedia production may include a selected subset of the available exemplar material.

In forming the customized image, a subject foreground image portion, such as a head, will be provided in electronic form to a computerized system. This subject foreground image portion will then be matched to another subject portion, which may be an external input, or selected from one or more stored other subject portions, such as human, animal, insect, alien, or "cyborg" bodies. The subject foreground image portion is then normalized in position and size, and optionally angle and 3-D orientation projection, and merged with the other subject body portion to created an anatomically appropriate entity.

The positioning information preferably comprises a single point, and the size information preferably comprises a single dimension. The first image, in such a case, is presumed to have a predetermined orientation of the first anatomical portion, i.e., the angle and 3D-orientation projection are already normalized to a sufficient degree. The second image is therefore one in which the desired orientation matches that of the first image. However, the positioning information may also include one or more vectors defining one or more additional degrees of freedom for normalization, the first

image information, comprising information relating to a three or four dimensional representation of the first anatomical portion. Thus, the set of fourth representations relates to the positioning, scaling, movement, or other characteristics of the anatomical portion, and optionally orientation and other factors. The set of fifth representations therefore allows selection or synthesis of an appropriate first anatomical portion from the first image information.

The electronic representation of the first subject portion, e.g., head, may be a single image, multiple still images of differing orientations, a video input, or a special standardized input from a subject for acquiring full information about the subject. Therefore, the present invention allows various types of input sources to be used to define the subject. This flexibility is defined in a different production level than the "story line", although the type of electronic representation employed may be used to modify certain customization features. For example, if the input is a single still image, the audio track and corresponding image may reference the "stiffness" of the subject. Likewise, where a full model of a subject is created, the final multimedia production may include scenes including exploitation of, or verbal references to the ability of the computer to fully animate the subject.

Assuming that a full model of the subject is not obtained, the merging process may be a simple superimposition of the first image information defined by the fifth set of representations, or a more complex process, such as "morphing", which allows a gradual transition between two images, e.g., the first image and a portion of the second image. Where the electronic representation of the first subject portion is a model, the second portion is preferably also a model so that a simple or complex formula may be used to form the final image of the combined subjects.

The resulting image is preferably output to a video recording device and/or displayed on a video monitor.

The present invention therefore provides customized templates for adding an external image to a stored video sequence, resulting in a different production for each separate customized input set. Likewise, audio information may be used to customize a stored audio sequence, in conjunction with the video sequence. On a more sophisticated level, the input image information need not be limited to a single image, such as a photograph, and may in fact be obtained from a number of still images, individual frames or frame sequences from a videotape, or specialized imaging for the purpose of creating a computer model of the subject. Thus, a number of facial orientations, expressions and transitions may be captured explicitly for the purpose of creating the production. In this case, the first digital representations then include complex information, and the set of third representations includes not only the position and size of the portion of the subject, but the complex information as well. The set of fourth representations also includes an identifier of the desired complex information which is either included within the first image information or synthesized therefrom.

As noted elsewhere, the foreground image need not be directly derived from the first image, and may be "tweened", i.e., formed as an interpolated image from two different images, "morphed", i.e., provided with a gradual transition between two or more extremes, or altered before combining or superposing on the background image. Therefore, if the background image is the body of a lion, such as "Lion King", the face of a child may be captured and altered to include lion-like features. In other scenes, the background image may be of "Beauty and the Beast", where the child may be merged with one of the characters, being altered to include relevant, consistent features. Likewise, color mapping may also be altered to suit the production, allowing the subject to change color or shade in synchronization with the background.

Where a desired facial expression or orientation is not included in the first image information, it may be interpolated or extrapolated therefrom. Thus, the face image information may be mapped onto a three dimensional generic facial model, and then projected into different orientations. Further, facial features may be animated to produce facial expressions not included in the original data set(s). Thus, the information used to construct the final output image need not be limited to size and position, and may be a more complex vector with temporal variations. While it is preferable to obtain actual images of the subject rather than generating such images, both methods may be used.

Where available, video images including facial expression changes, such as between smile and frown, open and closed mouth, neck turning left and right and up and down, provides source material to produce more realistic images, allowing the image to "come to life" in the resulting video in a visually dynamic fashion.

According to one embodiment of the present invention, the final merging process occurs in real time. Therefore, it is preferred that before the final merging process occurs, all necessary preprocessing is completed, which may include interpolations, "morphing", modelling, "tweening" and the like. Certain tasks which are not completed in real time may be processed concurrently with the final merging process, so long as the tasks are assured to complete before the resulting data is required for merging. Thus, in a preproduction stage, images are input into the system and are parameterized and preprocessed, to extract the desired portion of the subject and position and scale it. Interpolation and digitization are also preferably performed in batch mode.

Interpolation between two different images of the same object may be performed by "tweening", a process wherein intermediate stages of transformation are created which maintain morphologically constant features and create a morphological "compromise" or intermediate for features which differ. For example, a transition between smiling and frowning may be partitioned into a number of intermediate stages in which the mouth and cheek morphology gradually changes from one extreme to the other.

The setup of batch mode processing may be quickly performed, allowing an operator to devote a limited amount of time to setting up a production and making any necessary decisions in a compressed amount of time. Thereafter, the production is automated, completing any batch mode processing and preceding to real-time recording or presentation of the production. This allows efficient utilization of manpower and high output. For sake of example, if 10 minutes are required to set up the batch processing, an additional 10 minutes to complete batch processing and finally 30 minutes to record the production, given sufficient hardware, a single operator will have a throughput of about six productions per hour.

The background image may be video, animated images, or still images. According to the present invention, the second image, or background image, includes the remaining portion of the subject. A further background image may also include external elements, and may optionally be integrated with the background image incorporating the remaining portion of the subject. For example, in a totally animated background, a single background image, including both the remaining portion of the subject and other elements is efficient. However, where the external elements are video

images, and the remaining portion of the subject is animated, it may be preferable to treat the two background images separately. Thus, a plurality of background frames may be merged under computer control into a single video.

Likewise, the audio information may include three components, the custom audio insert, such as a name or other appropriate utterance, the audio template, and background audio, such as music or sound effects. These three components may be merged in real time during the production stage.

With a modular design of production, subject information from a variety of sources may be efficiently and optimally incorporated into the production. Thus, the first image may be one or more photographs, video, or taken directly at the production site from the subject itself. Music and voice may be included, as well, from previously prepared recordings or a microphone during batch processing preparation. Custom graphics and the like may also be optionally included.

According to an alternative embodiment of the present invention, the first image information of the subject is first processed to produce a cartoon image. This may be performed by a caricature or cartoon artist using standard materials, by an automated processor, or by an operator assisted automated processor. In creating a custom cartoon image, the anatomical integrity of the image should be maintained, so that the head portion may be successfully merged with the body portion during production. Thus, artistic freedom is limited to anthropomorphically appropriate elements and dimensions for proper computerized identification. The cartoon image process is advantageous because it allows simplified modelling of the subject without requiring photorealistic imaging of the natural subject. Mouth, eyes, nose, hair and eyebrows may all be modelled as three dimensional objects and controlled to move in real time, allowing fluid movements of the two dimensional projection of the character in the final production. The use of a human artist to abstract human facial features and create a caricature allows a high level of customization while providing means for standardization. Thus, certain features may be accentuated based on information not available in an image alone, resulting in an enhanced customized production.

When a human artist assists in capturing the features of the subject, a picture may be drawn, which is then scanned into a computer as the first image. Alternatively, the image may be created on a digitizing tablet. Further, the artist may work using a mouse or other input directly with a video image to construct the first image. The artist-created image is then employed directly or further processed by the computer, such as by being applied to a model cartoon character. When the artist works interactively with the computer to generate the first image, the data may be entered directly into a model, which may be directly animated, or have model parameters varied.

It is noted that, in many instances, the background image need not be employed as a digitized image, except for genlock (video scan synchronization) and overlay, at any point in the processing, and therefore in large part passes without distortion from a source to the production. This allows the background image to be stored on video tape, laser disk, or other analog storage medium. Of course, the background may also be stored as digital video, in uncompressed or compressed form, e.g., MPEG-2. Production synchronization may be by way of standard SMPTE timecodes. Thus, a custom cartoon character may be overlayed on external elements of a background.

In a preferred embodiment according to the present invention, audio information is provided, including both a first audio portion associated with the first image information and a second audio portion associated with the second image. A set of audio representations associated with the second image is used to determine the timing and optionally characteristics of information from the first audio information in a resulting soundtrack created by merging with the second audio information.

The first audio information may be, e.g., a name, spoken in various intonations, associated with the first image information. The second audio information may be, e.g., a story associated with a sequence of second images, with the set of audio identifiers relating to the timing and intonation of the name to be inserted in the soundtrack.

For a full understanding of the present invention, reference should now be made to the following detailed description of the preferred embodiments of the invention as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the invention will be shown by way of drawings of the Figures, in which:

FIG. **1** is a diagram showing one frame of an image in which a boy's head is superimposed upon a hand-drawn boy's body;

FIG. **2** is a perspective view showing how the head of a human subject, in various angular positions, is electronically scanned to produce a plurality of electronic images;

FIG. **3** is a block diagram of an electronic system employed, according to the present invention, to produce electronic images of the type shown in FIG. **1**;

FIGS. **4***a* and **4***b* are image frames containing the head of a human subject in front and side views, respectively, as may be obtained with the apparatus of FIG. **2**;

FIGS. **5***a* and **5***b* depict image frames in which the head of a human subject has been enlarged and reduced in scale, respectively;

FIG. **6** depicts an image frame containing the body of a human subject, without a head;

FIG. **7** depicts an image frame in which the head of a human subject has been superimposed upon the body shown in FIG. **6**;

FIG. **8** is a representative diagram of a voice recording showing how the name of a person is inserted into a line of text;

FIG. **9** is a block diagram of the an electronic system, according to the invention, for inserting the name of a person in a voice recording;

FIG. **10** is a flow chart of a computer program for implementing the electronic image producing process in the apparatus of FIG. **3**;

FIG. **11** is a flow chart of a computer program for implementing the audio recording process in the apparatus of FIG. **9**;

FIG. **12** is a graphical flow chart depicting the transformations according to the present invention;

FIG. **13** depicts images having differing positioning;

FIG. **14** is a semi-schematic view of an apparatus for obtaining customization information;

FIG. **15** is a block diagram of an embodiment according to the present invention;

FIG. **16** depicts two images with "tweened" frames, which if presented dynamically, provide a "morphed" image; and

FIG. 17 depicts a starting and ending frame of a "morph" transition, with several interframes.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will now be described with reference to FIGS. 1–17. Identical elements in the various figures are designated with the same reference numerals.

FIG. 1 illustrates a typical electronically displayed image flame wherein the head **10** of a male child is superimposed upon a hand-drawn body **12**. As may be seen, the head and body are in the proper relative proportions and the head is disposed upon the body at the proper location. This is the type of composite image which is automatically produced by the method and apparatus according to the present invention.

FIG. 2 illustrates how the head of a human subject can be scanned by an electronic scanner to form stored images. In this case, a video camera **14** is arranged to view the head **16** of the human subject. This human subject stands on a platform **18** which is rotated about a vertical axis **20**. In this way, a plurality of video flames are obtained, each containing the image of the head **16** in a different angular position. These video flames are stored on a video cassette recorder (VCR) **24**. The stored video flames may be thereafter digitized, in an analog-to-digital converter, to provide digital representations of each frame.

Alternatively, the video flames containing the image of a human head can be obtained flora a photograph of the human subject. For example, a Hewlett-Packard Scanjet® scanner may be employed to electronically scan a photograph and produce digital representations defining an image flame. Perspective views of the subject may be artificially generated from one or more views of the subject, by processing the electronically stored image based on a model of a human subject's head.

In order to provide special effects, the stored image may be "morphed" with another image for display. The process of "morphing" involves creating a series of morphologically defined interpolations between two corresponding images, with preservation of fluid continuity between corresponding features, i.e., edges, eyes, nose, mouth, neck, hair, etc. This allows, for example, a transition from a human head to an animal head. Alternatively, the stored image may be "tweened" with another image, forming an interpolation of the two images, which allows a more natural attachment and posture of a human head on an animal or other type body, and assists in animating the human head according to a predetermined choreography. In general, "morphing" or "tweening" will be performed in a batch processing mode prior to final production, although this is not required.

FIG. 16 shows two extreme images, and a series of interpolations between the two extremes. Each of the interpolations is a "tweened" frame, while the series of interpolations is a "morphed" sequence. In general, for presentation, a "tweened" frame is more carefully prepared from closely corresponding images, and all significant features remain defined, as these will be distinctly visible for a period of time. On the other hand, when presented as a series of frames, certain features in a "morphed" image may become momentarily indistinct during the transition, especially during dramatic transformations, as shown in FIG. 17.

EXAMPLE 1

FIG. 3 illustrates a first apparatus employed for implementing the image-making method according to the invention. As is shown there, the system comprises an analog-to-digital converter **22** which can receive video image frames from the video cassette recorder **24** or digitizes images in a flat bed scanner **26**. The flat bed scanner **26**, which may, for example, be a Hewlett Packard Scan Jet® or Sony flat bed scanner, electronically scans an image, e.g., 8½×11 inch hand drawn art work or an 8×10 inch photograph.

The digital representations of each image frame are supplied to a digital image frame store **28** which, in turn, is addressable by an IBM compatible 80486DX2/66 personal computer (PC) workstation **30**. Of course, Intel Pentium®, Apple Power PC, or other processors are known which may be employed for image processing. The frame store is preferably an IBM rewritable optical disk, although a magnetic disk, RAM or other type of memory may be used to store the image frames. The PC workstation **30** is provided with a video adapter, such as is available from Targa Systems, Inc. of East Berlin, Conn., USA, under model name "True Vision Targa Plus 64 Board", for displaying television images on the workstation CRT screen **36** from digital representations of such images.

The image frames composed by the PC workstation **30** are supplied in digital form to a digital-to-analog converter **32** which, in turn, passes the analog signal to a VCR **34** or other video recording device.

The PC workstation **30** operates with two applications programs namely, AVS 4000 and AVS 5000, which are also available from Targa Systems, Inc. These programs, which may be used to implement the method according to the present invention for automatically superimposing the head of a human subject on a body contained in an image frame, will now be described in detail.

As shown in FIGS. 4*a* and 4*b*, the image of a human head is initially electronically scanned and then digitized, and a set of first digital representations defining a first image frame are stored in the frame store **28**. The operator of the PC workstation **30** next displays the image of the head **16** on the workstation CRT screen **36** and selects a suitable frame size **40** for the image. In addition, the workstation operator selects a reference point on the first image frame **40** which indicates the location of the head with respect to the frame. This reference point is preferably a central point at the bottom of the chin, in the case of a full-face view, and a central point at the top of the neck in the case of a side view. These reference points are shown as points **42** and **44**, respectively, in FIGS. 4*a* and 4*b*.

As a next step, the workstation operator causes the workstation to scale the image of the head, and produce and store digital representations of the head in a plurality of sizes, as shown in FIGS. 5*a* and 5*b*. Digital representations associated with each stored frame also define (1) the location of the reference point **42**, indicating the location of the head on this frame, and (2) the size of the head in this first frame.

Previously scanned, e.g., by the flatbed scanner **26**, and entered into the frame store **28**, are digital representations of a picture containing the body of the human subject. The image frame containing this body is also displayed on the CRT display by the operator of the PC workstation. By observing the image, the operator produces a set of digital representations associated with this image frame defining (1) a reference point **46** on the frame **44** specifying the desired location of the head on this frame, (2) the desired size of the head on this frame **44**.

Thereafter, the operator superimposes the image frame **40** containing the human head **16** in the desired size upon the image frame **44** with the reference point **42** superimposed upon the reference point **46**.

Finally, the superimposed images, so generated, are supplied to a digital-to-analog converter which converts the image to a single frame in NTSC format which is then recorded on a VCR **34**.

FIGS. **8** and **9** illustrate how a voice recording may be generated to provide a custom tailored soundtrack for a video recording. In this example, digital representations of the name of a human subject, "JASON", is inserted in a pro-recorded and digitized soundtrack.

FIG. **8** represents an excerpt from a magnetically recorded soundtrack **50**. According to the present invention, the word "JASON" with the proper intonation, is inserted at the beginning and end of pre-recorded sentences.

FIG. **9** is a block diagram showing an apparatus for implementing the method. This system comprises a microphone **52**, analog-to-digital converter **54**, a PC computer workstation **56**, a digital-to-analog converter **58** and the VCR **34**. The PC workstation **56** contains an IBM audio capture and playback adapter with associated software.

The method of producing the voice recording of FIG. **8**, with the aid of the apparatus of FIG. **9**, will now be described.

Initially, the text of the voice recording, without the inserted name, is spoken into the microphone **52**. This text is recorded in digital form on the hard disk memory of the PC workstation. Thereafter, the name of a human subject, e.g., "JASON", is spoken into the microphone **52** with three different intonations: declaratory, exclamatory and interrogatory. These sounds are also digitized and stored on the workstation hard disk.

Preferably, an entire library of names is so recorded on the workstation hard disk for later use. Of course, different names may be synthesized by a computer system based on the pronunciation of the name and a voice synthesis algorithm. The audio sound track may also be processed on an Apple Macintosh computer with sound capability.

When a video cassette recording is made, the audio data is automatically supplied via the digital-to-analog converter **58** to the VCR **34**. Personal names, e.g., "JASON", with a proper intonation, are inserted in this audio data stream on the fly. If the name is to be added at the end of a sentence, digital representations thereof are added "flush left", i.e., with a variable length sound gap between the end of the sentence and the beginning of the next sentence; if it is to be inserted at the beginning of a sentence, the digital representations are added "flush right", i.e., with a variable length gap before the name, so that the sentence will sound "natural" in reproduction. The name may also be embedded in the sentence, with variable length gaps at pauses within or at the beginning and/or end of the sentence.

EXAMPLE 2

As illustrated in FIG. **10**, the video and audio "personalization processes", respectively, according to the invention are carried out as follows:

Video Personalization:

First, a photograph of a child (any size) which includes a child's head—e.g., in full face view—is scanned using a color video scanner. That digitized image is saved using the Targa AVS 5000 software on a 486 PC workstation. (Block **60**).

After being saved, the image of the child's head is digitally "cut-out" using a computer tablet and the tablet's pointing device. The cutting-out is accomplished by tracing the edge of the child's head with a light pink line. This shade of pink has the ability to blend the edges of the child's head with the background colors in other illustrations or scenes ("background images"). (Block **62**).

The cut-out head is saved after pink pixels are added to the corners of the image ("foreground image"). These pixels are added because the heads are ultimately justified against the background images according to the bottom left-hand corner of the foreground image, and the pixels in the corner prevent differently oriented and sized heads from being automatically positioned incorrectly relative to the position of the illustrated body in the background image.

Next, using the PC workstation, the scanned-in head is automatically scaled to up to 30 different sizes, from small to large, each of which is saved as an individual foreground image with a distinct name (**F1**, **F2**, **F3**, etc.) to produce a file called "Faces". The head is in some cases also flipped (mirror imaged) and/or rotated. (Block **64**). Of course, with sufficiently powerful computing hardware, these images may be scaled "on-the-fly".

As a next step, using the PC workstation, the proper foreground image (**F1**, **F2**, **F3**, etc.) is retrieved from the file "Faces" and superimposed automatically upon the next successive background image of a video story (**ABC1**, **ABC2**, **ABC3**, etc.) at its proper location. Thereafter, the combined image is stored on a hard disk or directly to a video storage device, such as a VCR.

The first name of the person shown in the Faces file is written out as text and this text is inserted in those background images (**ABC1**, **ABC2**, etc.) that include the child's name. (Block **66**).

The presentation ("story") is now recorded from the hard drive of the PC workstation to a videotape (or other possible media in the future). The story consists of a sequence of video and audio elements (images, voice messages, music) that are played in a predetermined order to create the story. In that sequence, the background images with the superimposed heads will appear in their predetermined places to create a personalized videotape. (Block **70**).

Audio Personalization:

An audio file called "Names" is first produced, containing digitized recordings of the various names spoken by a voice artist. (Block **68**). Of course, a computer synthesized voice may be used, especially if it is tuned to sound human.

When the presentation is created, the appropriate name is inserted at the predetermined point in the story. The name is "justified", either right or left, so that it will be naturally spoken in the context of the sentences in which it appears, with no unwanted pause between the name and preceding or subsequent words, or at other portions of the soundtrack, and so that the soundtrack remains in synchronization with the video sequence. (Block **70**).

FIG. **11** illustrates how the personalized presentation is created (Block **70**) from the files of digital representations containing the foreground images ("Faces") **72**, the background images ("ABC") **74**, the voice file for "Names" ("N") **76**, the voice file for narrative ("ABCV") **78** and the music file ("ABCM") **80**. As explained above, the video presentation is created by superimposing the correct image of a head (**F1**, **F2**, **F3**, etc.) on successive background images **ABC1**, **ABC2**, **ABC3**, etc.

The audio presentation is created by superimposing digital representations of the names **N1**, **N2**, **N3**, etc. over the voice file ABCV1, ABCV2, ABCV3, etc. In addition, successive digital representations from the music file ABCM1, ABCM2, ABCM3, are supplied at proper intervals.

There results a presentation file **82** which is stored on the hard disk and then "played" through the digital-to-analog converter to a VCR to produce a videotape.

EXAMPLE 3

In contrast to the system described in examples 1 and 2, an alternative system is provided which allows the production to occur in real time and be synthesized, sequenced and directly recorded on a video tape **100** or other video recording device.

Thus, according to this embodiment, a source background video sequence may be provided on a master videotape, in a video tape player **101**. In each frame, a foreground image is supplied from a library of images in memory **102**, which may include images varying in perspective, size, action (e.g., mouth open, mouth closed, eyes open, eyes closed, smiling, frowning, etc.), lighting, or other characteristics. The image library may also be supplemented with synthesized images, which are interpolated or extrapolated from actual images.

The source background video sequence is coded with SMPTE time codes **103**, and may also have other associated information. For example, a close-captioned signal may be included with the audio text, and information regarding the optimum location and orientation of the image.

The source background video image **104** is fed to a 486 PC computer **105** with a modified Television Laboratories Director Turbo system video processor. This video processor allows the facial image to be scaled, rotated and placed in real time on the background video image. The sequence of foreground images is determined by a predetermined program keyed to the SMPTE time codes **103**. Therefore, the processing of the foreground image proceeds in sequence, through a series of selections and transformations of the foreground image data.

The audio track **106** is processed by an Apple Macintosh computer **107**. Based on a preprogrammed sequence, the SMPTE time codes **103** from the background video sequence control the audio system. At selected chronological locations within the audio sequence, the name of the child is inserted, with the proper intonation and timing. Based on the linguistic relationship of the inserted name, which will have a variable duration, to the remainder of the audio track, which will have a fixed timing, gaps may be added or reduced to maintain the appropriate synchronization. If close caption signals are provided, these may be updated with the child's name as well.

The fixed audio track is preferably recorded on an audio tape, separate from the source background video signal, with only the variable portion, i.e., the child's name, provided by the Apple Macintosh. Of course, the entire audio sequence, including both the fixed and variable portions, may be provided by the audio subsystem, separate from the video source, especially where more complex variable portions are provided, wherein the final production is provided based on the SMPTE time codes, synchronizing the audio and video in the layback process.

The SMPTE code may be either a longitudinal time code (LTC) or a vertical interval time code (VITC), although the LTC is preferred.

The library of images, stored in memory **102**, of the human subject as the foreground image may also be interpolated with the background video image sequence, although this is not generally performed in real time, i.e. the interpolated background image cannot generally be directly transferred to the output videorecorder at about 30 frames per second, but rather at a much slower rate due to processing delay.

In the "morphing" or "tweening" process, the foreground human subject image, i.e., the facial image, is coded by hand or through an automated feature coding system, to identify the desired anatomical features such as eyes, ears, nose, mouth, hair, and the like as anchors for the interpolation process. The subject source background image is precoded for corresponding features, and preferably separated from other background elements. During the pre-production process, frames with the subject foreground and subject background images are interpolated, either in a fluid transition, i.e., "morphed", or as a hybrid, i.e., "tweened", in a manner which primarily preserves the characteristics of the subject foreground image for the primary facial features, and which preserves distinctive contextual subject background features, so that the resulting image is identifiable as the original subject, with morphological modifications. The interpolated images are then stored and merged with the background image during final production.

Further, the foreground image may be altered in expression, and, for example, lips from a still image may be made to appear to move.

It is also possible to perform an image interpolation in real time, so that the foreground subject image is merged with the background subject image during the final production; however, this requires a great amount of processing power.

EXAMPLE 4

The method according to example 3 is implemented as follows:

First, an sequence of images of a human subject head is obtained by means of a video camera **14** or other electronic imaging system. These images differ in orientation and positioning, an a manner which is recorded in conjunction with the image. Therefore, a desired positioning and orientation for a cohesive match with the background image may be obtained by selecting the closest image actually obtained, which may then be further transformed by linear scaling, interpolation, or other processing. The subject stands on a turntable **18**, which turns about axis **20**. The rotation of the turntable **18** is controlled by a control **110**, which is interfaced to a synchronizer **111**, which also synchronizes a videotape recorder **24**, which receives a signal from a videocamera **14**, directed at the head **16** of the subject.

The human subject head is then separated from the remaining features either automatically or manually. For example, if the images are obtained in front of a blue screen, a chroma-key unit may be used to provide a transparent margin for the foreground image. Alternatively, the edge of the head may be traced by an image processing algorithm to remove the remaining external features. The separation may also be performed manually, as described above with respect to examples 1 and 2.

A unique positioning may be automatically determined for each image, e.g. **131–138**, for example by determining a central axis v and a point p, i.e., the lowest portion of the face, the chin, as shown in FIG. **13**. The size or scaling of the head may also be determined by measuring a distance from the bottom to top of the head, i.e., along the central axis, and relating this distance to a standard, as depicted in FIG. **12**. In FIG. **12**, a foreground image **121** is separated into a head portion **122**. A point p is determined which defines a positioning of the head **122**. The scaling of the head **122** is also determined by measuring a characteristic dimension x. The characteristic dimension x is related to a desired dimension y and the head rescaled to a new head image **123**. The background image **124** defines a background, as well as a desired positioning d and the desired scaling. The scaled

foreground image 123 is merged with the background image 124 by superposing the scaled head 123 with the defined point of the scaled head 123 coinciding with the desired positioning d.

The positioning and scaling may also be manually determined, in accordance with the above description with respect to examples 1 and 2.

A background graphic sequence is provided, preferably on an SMPTE encoded videotape. A corresponding file includes information relating the SMPTE codes with desired positioning and scaling of the foreground image. The background image is then fed to a video processor, e.g., the aforementioned Television Laboratories Director Turbo system, where it is digitized and temporarily stored in a frame buffer. The video processor receives a selected foreground image, which is then scaled and positioned in real time. The foreground image is overlayed on the background image and output from the video processor as an NTSC signal, which is recorded on a video recorder.

Simultaneously with the video processing, the SMPTE codes are used to determine an audio track. A constant audio track is provided in synchronization with the background video. The SMPTE codes are fed to a Macintosh computer, which is preprogrammed to relate the sequence of audio information. At particular times, a variable audio portion, i.e., a name, is inserted in the audio track. The predetermined sequence also includes information regarding the placement of the variable portion within the allotted timespace. Thus, the variable audio may be placed at the beginning, end, or middle of the timespace. The variable audio portion and the fixed audio portion are then mixed and recorded with the composite video on the video cassette recorder.

Of course, it should be understood that sequences of video buffer frames may also be present around the time occurrence a variable speech portion. Therefore, the length of the gap between fixed audio portions may be varied by truncating frames or by providing interpolated frames in the variable time portion, so that variable length sound gaps need not occur.

There has thus been shown and described a novel method and apparatus for producing an electronic image which fulfills all the objects and advantages sought therefor. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to those skilled in the art after considering this specification and the accompanying drawings which disclose the preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention, which is to be limited only by the claims which follow.

What is claimed is:

1. A method of producing an electronic image of a subject, said method comprising the steps of:

(a) electronically inputting a first image of at least a portion of said subject and storing a set of first digital representations defining said first image in a foreground electronic image frame;

(b) generating a plurality of second images of a picture containing a remainder portion of said subject and storing a plurality of sets of second digital representations, each set defining one of said second images in a background electronic image frame;

(c) producing a set of third digital representations associated with said foreground frame defining (1) a first reference point on said foreground frame indicating the location of said subject portion in said foreground frame, and (2) the size of said subject portion in said foreground frame;

(d) producing a set of fourth digital representations associated with each of said background frames defining (1) a second reference point on each respective background frame specifying the desired position of said subject portion in said background frame, and (2) the desired size of said subject portion in each respective background frame;

(e) converting said set of first representations of said first image into a plurality of sets of fifth representations, in dependence upon the size information defined by said set of third representations and said plurality of sets of fourth representations, each set of said fifth representations defining said foreground frame with said subject portion scaled to said desired size and located at said desired position in a respective one of said background frames;

(f) combining said set of fifth representations defining said foreground frame upon said set of second representations defining said background frame such that said first and second reference points substantially coincide, to produce a plurality of sets of sixth digital representations, each defining a respective final electronic image frame containing said subject portion disposed upon said remainder of said subject at said desired position and with said desired size; and

(g) storing said plurality of said sets of said sixth digital representations to provide a sequence of said final frames.

2. The method according to claim 1, further comprising the steps of:

(h) storing a sound sequence associated with said sequence of final frames; and

(i) producing a video recording comprising said sequence of final frames and said associated sound sequence.

3. The method according to claim 2, further comprising the step of producing an audio recording associated with said third image as said sound sequence, said recording including a sequence of seventh digital representations defining the sound of spoken words.

4. The method according to claim 3, wherein said audio recording producing step includes the step of inserting into said sequence of seventh digital representations a set of eighth digital representations defining the sound of a spoken word or phrase.

5. The method according to claim 4, wherein said word or phrase is a name.

6. The method defined in claim 4, wherein said set of eighth digital representations defining said spoken word or phrase is selected from a plurality of sets of eighth digital representations.

7. The method defined in claim 6, wherein said set of eighth digital representations defining said spoken word or phrase is selected from a plurality of sets of eighth digital representations, each set defining a spoken word or phrase which differs in meaning or intonation.

8. The method according to claim 4, wherein said sequence of seventh representations defines a phrase having a beginning and an end; wherein each member of said set of eighth representations has a beginning and an end; and wherein the beginning or end of said set of eighth representations is inserted at the end or beginning of a phrase of said sequence of seventh representations, respectively.

9. The method according to claim 1, wherein said plurality of second images define a motion video sequence.

defined by said actual size and said second desired size, representing scanned image of said head scaled to said second desired size; and

(j) outputting said head, electronically rescaled to said second desired size, superposed on said body.

8. The method according to claim **1**, wherein said outputting step comprises generating said processed electronic representation as a composite video image of said scanned image of said head scaled to said desired size.

9. The method according to claim **1**, wherein colors in said image of said head are altered in correspondence to said colors of said drawing.

10. The method according to claim **1**, wherein said body includes a collar immediately adjacent to a location of said superimposed head.

11. The method according to claim **1**, further comprising the step of producing an audio recording associated with said processed electronic representation, said recording including a sequence of spoken words, having inserted therein a sound including a name of a person.

12. The method according to claim **1**, further comprising the step of extracting positional information from said image of said head, and wherein said outputting step further comprises outputting said head having a positional predetermined relation to said body based on said positional information.

13. The method according to claim **1**, further comprising the steps of:

(g) providing a plurality of images each having a representation of a body and a corresponding desired size of an associated head;

(h) processing said electronic representation of said image of said head a plurality of times in dependence on the size information defined by the actual size and the desired size relating to said plurality of representations of a body;

(i) extracting positional information from said image of said head; and

(j) said outputting step comprising outputting, in a plurality of images, for each representation of a body, said processed electronic representation as an image of said head rescaled to said desired size and having a predetermined relation to said respective body based on said positional information.

14. The method according to claim **13**, further comprising the step of associating with each of said plurality of output images, an audio stream, comprising a first portion associated with an identification of said head and a second portion associated with said body, said first and second portions having a predetermined temporal relationship.

15. The method according to claim **1**, further comprising the step of associating said outputted image with an audio stream, said audio stream comprising a first portion associated with an identification of said head and a second portion associated with said body, said first and second portions having a predetermined temporal relationship.

16. A method of producing a composite electronic image of a subject comprising the steps of:

(a) obtaining a first image and extracting information relating to a head of a subject from the image, and producing a set of first representations of the first image;

(b) producing a set of size representations associated with the first image information defining an actual size of the head;

(c) providing a normalized size parameter associated with a body;

(d) digitally converting the set of first representations of the first image into a set of second representations, in dependence upon the normalized size parameter, the set of second representations defining the head rescaled to the desired size; and

(e) outputting the head, anatomically superposed on said body, as image data.

17. The method according to claim **16**, further comprising the step of associating with said outputted image an audio stream, comprising a first portion associated with an identity of said head of said subject and a second portion associated with said body, said first and second audio portions having a predetermined temporal relationship.

18. The method according to claim **16**, further comprising the step of extracting positional information from said image of said head, and wherein said outputting step further comprises outputting said set of second representations in conjunction with said body and having a natural relation to said body based on said positional information.

19. A method of producing a composite image of a subject comprising the steps of:

(a) receiving a raster electronic image of a subject and extracting from the image an anatomical portion of the subject, from a remainder of the image;

(b) associating a reference with the extracted anatomical portion to define an anatomical location;

(c) determining a size of the extracted anatomical portion based on a determined actual size of the extracted anatomical portion;

(c) superimposing the extracted anatomical portion on top of a first predetermined image including an anatomically adjoining portion and a background graphic, to provide an anatomically correct juxtaposition of the anatomical portion with the anatomically adjoining portion overlying the background graphic, wherein the juxtaposition is based on the associated reference and the anatomical portion is normalized in size to the anatomically adjoining portion based on a first normalization parameter associated with the first predetermined image;

(d) outputting the juxtaposed anatomical portion with the first predetermined image as a composite image.

20. The method according to claim **19**, wherein the anatomical portion is a head of the subject.

21. The method according to claim **19**, further comprising the steps of:

superimposing the extracted anatomical portion on top of a second predetermined image, including an anatomically adjoining portion and a background graphic, to provide an anatomically correct juxtaposition of the anatomical portion with the anatomically adjoining portion overlying the background graphic, wherein the juxtaposition is based on the associated reference and the anatomical portion is normalized in size to the anatomically adjoining portion based on a second normalization parameter associated with the second predetermined image, wherein the first and second normalization parameters are different; and

outputting the superimposed anatomical portion with the second predetermined image as a composite image.

22. The method according to claim **21**, wherein said outputting step comprises printing the composite image on a recording medium.

23. The method according to claim **21**, wherein said outputting step comprises generating the composite image as a video signal.

24. The method according to claim 21, further comprising the step of associating said outputted image with an audio stream, the audio stream comprising a first portion associated with an identification of the subject and a second portion associated with the first image, said first and second portions having a predetermined temporal relationship.

25. The method according to claim 21, wherein the first predetermined image comprises a buffer zone that visually obscures misalignment and visual artifacts from superimposition of the extracted anatomical portion.

26. A method of producing a composite electronic image of a subject comprising the steps of:

(a) obtaining a first image of a subject and separating information relating to a first anatomical portion of the subject from a remainder of the first image, and producing a set of first representations of the first anatomical portion of the subject;

(b) producing a set of digital representations associated with the first image, defining an actual size and anatomical orientation of the first anatomical portion;

(c) providing normalization parameters, the normalization parameters representing a size and anatomical positioning of a predetermined image, the predetermined image comprising an anatomically adjoining part;

(d) converting the set of first representations of the first image into a set of second representations, in dependence upon the normalization parameters and the set of digital representations, the set of second representations defining the first anatomical portion rescaled and reoriented to adjoin the anatomically adjoining part;

(e) superimposing the set of second representations into the predetermined image in anatomically correct juxtaposition with the anatomically adjoining part; and

(f) outputting the second representations superimposed on the predetermined image as image data.

27. A method of producing an electronic audio program, said method comprising the steps of:

(a) providing an electronic representation of a customizable audio program, having a set of predetermined insertion points and associated context;

(b) providing an electronic representation of a variable audio program portion from an external source;

(c) producing a set of digital representations defining a duration of the variable audio program;

(d) merging the customizable audio program and the variable audio program while time-justifying the variable audio program within the customizable audio program based on the predetermined insertion points and associated context, to produce a natural speech pattern; and

(e) outputting the merged audio program.

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